Access DB# 104053

SEARCH REQUEST FORM

16

Scientific and Technical Information Center

Requester's Full Name: Nicole Barreca Examiner # : 76619 Date: 9/16/03
Art Unit: 1756 Phone Number 308-7968 Serial Number: 09/975211
Mail Box and Bldg/Room Location: CP3 9D-29 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

****

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: CO_2 - Processes Photoresists Polymers, and Photoactive Compounds for microlithography
Inventors (please provide full names): Jonathan Kendall Joseph M. DeSimone Ruben G. Carbonell Christopher L. McAdams

Earliest Priority Filing Date: 10/12/00

***For Sequence Searches Only* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.**

A method forming a resist image comprising:

→ contacting the substrate with a first composition comprising carbon dioxide and a component selected from the group consisting of at least one polymeric precursor at least one monomer at least one polymeric material & mixtures thereof, to form a coating

→ imagewise exposure

→ developing the coating of carbon dioxide wherein the polymer or monomer is selected from attached claims 17, 21, and 33

****

STAFF USE ONLY	**Type of Search**	**Vendors and cost where applicable**
Searcher: K. Fuller	NA Sequence (#)	STN ✓
Searcher Phone #:	AA Sequence (#)	Dialog
Searcher Location:	Structure (#) 12	Questel/Orbit
Date Searcher Picked Up:	Bibliographic	Dr.Link
Date Completed: 9/22/03	Litigation	Lexis/Nexis
Searcher Prep & Review Time: 30	Fulltext	Sequence Systems
Clerical Prep Time:	Patent Family	WWW/Internet
Online Time: 71	Other	Other (specify)

PTO-1590 (8-01)

Scientific & Technical Information Center
USPTO

STIC Search Report
EIC 1700

STIC Database Tracking Number: 104053

TO: Nicole Barreca
Location: CP3 9D29
Art Unit : 1756
September 22, 2003

Case Serial Number: 09/975211

From: Kathleen Fuller
Location: EIC 1700
CP3/4 3D62
Phone: 308-4290

Kathleen.Fuller@uspto.gov

Search Notes

09/975,211

STIC Search Results Feedback Form

USPTO

EIC17000

Questions about the scope or the results of the search? Contact ***the EIC searcher or contact***:

Kathleen Fuller, EIC 1700 Team Leader
308-4290, CP3/4-3D62

Voluntary Results Feedback Form

- *I am an examiner in Workgroup:* ☐ *Example: 1713*
- *Relevant prior art **found**, search results used as follows:*

  ☐ 102 rejection

  ☐ 103 rejection

  ☐ Cited as being of interest.

  ☐ Helped examiner better understand the invention.

  ☐ Helped examiner better understand the state of the art in their technology.

  Types of relevant prior art found:

  ☐ Foreign Patent(s)

  ☐ Non-Patent Literature
  (journal articles, conference proceedings, new product announcements etc.)

- *Relevant prior art **not found:***

  ☐ Results verified the lack of relevant prior art (helped determine patentability).

  ☐ Results were not useful in determining patentability or understanding the invention.

Comments:

Drop off or send completed forms to STIC/EIC1700 CP3/4 3D62

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Search and Information Resources Administration

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STRUCTURE FILE UPDATES:    21 SEP 2003  HIGHEST RN 590345-44-1
DICTIONARY FILE UPDATES:   21 SEP 2003  HIGHEST RN 590345-44-1

TSCA INFORMATION NOW CURRENT THROUGH JULY 14, 2003

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Crossover limits have been increased.  See HELP CROSSOVER for details.

Experimental and calculated property data are now available.  See HELP
PROPERTIES for more information.  See STNote 27, Searching Properties
in the CAS Registry File, for complete details:
http://www.cas.org/ONLINE/STN/STNOTES/stnotes27.pdf

=> FILE HCAPLUS
FILE 'HCAPLUS' ENTERED AT 16:26:31 ON 22 SEP 2003
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FILE COVERS 1907 - 22 Sep 2003  VOL 139 ISS 13
FILE LAST UPDATED: 21 Sep 2003  (20030921/ED)

 This file contains CAS Registry Numbers for easy and accurate
 substance identification.


=> D QUE
L36            1 SEA FILE=REGISTRY ABB=ON  "1,1-DIHYDROPERFLUOROOCTYL ACRYLATE"/
                 CN
L37            1 SEA FILE=REGISTRY ABB=ON  .ALPHA.-FLUOROSTYRENE/CN
L38            1 SEA FILE=REGISTRY ABB=ON  "HEXAFLUOROPROPYLENE OXIDE"/CN
L41            1 SEA FILE=REGISTRY ABB=ON  TETRAFLUOROETHYLENE/CN
L42            1 SEA FILE=REGISTRY ABB=ON  "VINYLIDENE FLUORIDE"/CN
L43            1 SEA FILE=REGISTRY ABB=ON  CHLOROTRIFLUOROETHYLENE/CN
L44            1 SEA FILE=REGISTRY ABB=ON  "PERFLUORO(PROPYL VINYL ETHER)"/CN
L45            1 SEA FILE=REGISTRY ABB=ON  "PERFLUORO(METHYL VINYL ETHER)"/CN
```

Claim 21

```
L46           79 SEA FILE=REGISTRY ABB=ON  BIS AND TRIFLUOROMETHYL AND 4(W)5(W)D
                 IFLUORO AND DIOXOLE
L47           23 SEA FILE=REGISTRY ABB=ON  C5F8O2/MF
L48            1 SEA FILE=REGISTRY ABB=ON  L46 AND L47
L49           11 SEA FILE=REGISTRY ABB=ON  C11H5F9/MF
L50           10 SEA FILE=REGISTRY ABB=ON  L49 AND 1/NR
L51            1 SEA FILE=REGISTRY ABB=ON  L50 AND BENZENE AND 2(W)ETHENYL
L52           10 SEA FILE=REGISTRY ABB=ON  L36 OR L37 OR L51 OR L38 OR L41 OR
                 L42 OR L43 OR L44 OR L45 OR L48
L53              STR
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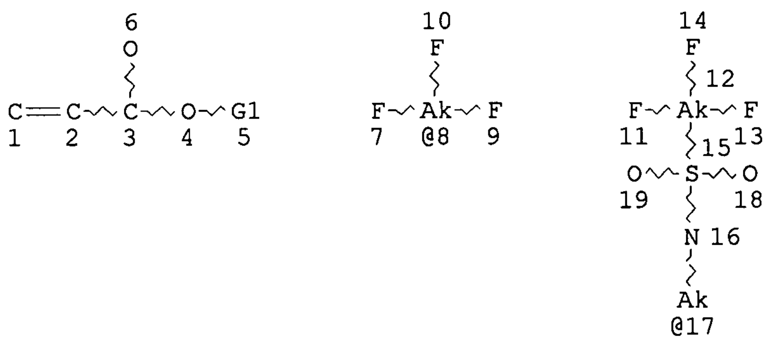

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VAR G1=8/17
NODE ATTRIBUTES:
DEFAULT MLEVEL IS ATOM
DEFAULT ECLEVEL IS LIMITED

GRAPH ATTRIBUTES:
RING(S) ARE ISOLATED OR EMBEDDED
NUMBER OF NODES IS  19

STEREO ATTRIBUTES: NONE
L55        14225 SEA FILE=REGISTRY SSS FUL L53
L56            1 SEA FILE=REGISTRY ABB=ON  CARBON DIOXIDE/CN
L57         8065 SEA FILE=HCAPLUS ABB=ON  L52
L58         6374 SEA FILE=HCAPLUS ABB=ON  L55
L59       169846 SEA FILE=HCAPLUS ABB=ON  L56
L60          395 SEA FILE=HCAPLUS ABB=ON  (L57 OR L58) AND L59
L61           92 SEA FILE=HCAPLUS ABB=ON  (L57 OR L58)(L)PHOTORESIST?
L62            9 SEA FILE=HCAPLUS ABB=ON  L60 AND L61
L63            9 SEA FILE=HCAPLUS ABB=ON  L61 AND (CO2 OR CARBON DIOXIDE)
L64            9 SEA FILE=HCAPLUS ABB=ON  L62 OR L63
L65           16 SEA FILE=HCAPLUS ABB=ON  L60 AND PHOTORESIST?
L66           21 SEA FILE=HCAPLUS ABB=ON  (L57 OR L58) AND PHOTORESIST? AND
                 (CO2 OR CARBON DIOXIDE)
L67           21 SEA FILE=HCAPLUS ABB=ON  (L62 OR L63 OR L64 OR L65 OR L66)
```

14,225 fluoro acrylate
Claim 21

21 CA references, on the utility

```
=> D L67 ALL 1-21 HITSTR

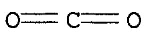
L67  ANSWER 1 OF 21  HCAPLUS  COPYRIGHT 2003 ACS on STN
AN   2003:609932  HCAPLUS
DN   139:157389
TI   Three dimensional microstructures forming method
IN   Bowman, Lawrence E.; Dunham, Glen C.
PA   USA
```

SO U.S. Pat. Appl. Publ., 8 pp.
CODEN: USXXCO
DT Patent
LA English
IC ICM G03F007-26
NCL 430312000; 430315000; 430324000
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 2003148222	A1	20030807	US 2002-72360	20020206
PRAI	US 2002-72360		20020206		

AB A method of forming complex three-dimensional microstructures is provided wherein an external stimulus is applied to a first layer of a photosensitive material, thereby creating voids in the first layer, and any material present in those voids is removed. A sacrificial material is then provided within at least a portion of the voids. This sacrificial layer fills the voids, either in whole or in part, and enables a second layer of photosensitive material to be stacked upon the first, while still preserving the pattern formed in the first layer. Once the sacrificial layer has been applied, a second layer of photosensitive material may then be stacked onto the first. Successive layers of photosensitive material and sacrificial material may be added until a final, complex three-dimensional structure is created. The sacrificial material may then be removed with a solvent such as **carbon dioxide**.
ST three dimensional microstructure forming method photolithog
IT Photolithography
(three dimensional microstructures forming method)
IT Fluoropolymers, preparation
RL: PNU (Preparation, unclassified); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(three dimensional microstructures forming method)
IT Perfluorocarbons
RL: TEM (Technical or engineered material use); USES (Uses)
(three dimensional microstructures forming method)
IT 71449-78-0 89452-37-9
RL: TEM (Technical or engineered material use); USES (Uses)
(photoacid generator; three dimensional microstructures forming method)
IT 28906-96-9
RL: TEM (Technical or engineered material use); USES (Uses)
(**photoresist**; three dimensional microstructures forming method)
IT **124-38-9, Carbon dioxide,** uses
RL: TEM (Technical or engineered material use); USES (Uses)
(supercrit.; three dimensional microstructures forming method)
IT 219484-64-7, HFE 7100
RL: MOA (Modifier or additive use); TEM (Technical or engineered material use); USES (Uses)
(three dimensional microstructures forming method)
IT **36087-79-3P,** Poly(perfluorooctyl methacrylate)
RL: PNU (Preparation, unclassified); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(three dimensional microstructures forming method)
IT 111972-81-7, AZ-5200 167749-18-0, ZEP-7000 572913-04-3, SU 8-50C
RL: TEM (Technical or engineered material use); USES (Uses)
(three dimensional microstructures forming method)
IT **124-38-9, Carbon dioxide,** uses

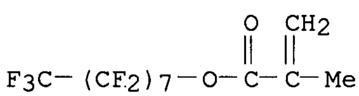
RL: TEM (Technical or engineered material use); USES (Uses)
(supercrit.; three dimensional microstructures forming method)
RN 124-38-9 HCAPLUS
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



IT **36087-79-3P**, Poly(perfluorooctyl methacrylate)
RL: PNU (Preparation, unclassified); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(three dimensional microstructures forming method)
RN 36087-79-3 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, heptadecafluorooctyl ester, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 15498-46-1
CMF C12 H5 F17 O2



L67 ANSWER 2 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 2003:511925 HCAPLUS
DN 139:61461
TI Method of undercutting micromechanical device with supercritical **carbon dioxide**
IN Miller, Seth Andrian
PA Texas Instruments Incorporated, USA
SO U.S. Pat. Appl. Publ., 15 pp.
CODEN: USXXCO
DT Patent
LA English
IC ICM G03F007-00
NCL 430311000; 430312000; 430313000; 430314000; 430330000
CC 76-3 (Electric Phenomena)
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 2003124462	A1	20030703	US 2001-34647	20011228
PRAI	US 2001-34647		20011228		

AB This invention relates to the field of micromech. devices, more specifically to the methods used to remove sacrificial layers from a micromech. device, and to methods used to remove sacrificial layers with a soln. comprising supercrit. **carbon dioxide**. A mixt. of supercrit. **CO2** with other solvents, co-solvents and surfactants is used during the process to remove sacrificial layers. The disclosed method has many advantages over the prior art, including a redn. of capillary forces that can damage the free-standing micromech. superstructures, an absence of plasma induced damage caused by ashing operations, and a redn. in the use of environmentally sensitive chems.

Another advantage of the disclosed process is that the swelling of the **photoresist** layers is minimized. The disclosed method may be used to remove sacrificial layers that were deposited during the process of fabricating micromech. devices. The method is also effective to remove a protective recoat layer that is deposited over a micromech. device after it has been fabricated.

ST micromech device undercutting supercrit **carbon dioxide**

IT Micromachining
Supercritical fluids
Surfactants
(method of undercutting micromech. device with supercrit. **carbon dioxide**)

IT Micromachines
(microelectromech. devices; method of undercutting micromech. device with supercrit. **carbon dioxide**)

IT Phenolic resins, processes
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(novolak, sacrificial layer; method of undercutting micromech. device with supercrit. **carbon dioxide**)

IT **Photoresists**
(sacrificial layer; method of undercutting micromech. device with supercrit. **carbon dioxide**)

IT Interconnections, electric
(via; method of undercutting micromech. device with supercrit. **carbon dioxide**)

IT 64-17-5, Ethanol, processes 67-56-1, Methanol, processes 67-64-1, Acetone, processes 78-93-3, Methylethyl ketone, processes 79-20-9, Methyl acetate 141-78-6, Ethyl acetate, processes 1634-04-4, Methyl tert-butyl ether
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(solvent; method of undercutting micromech. device with supercrit. **carbon dioxide**)

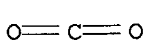
IT **124-38-9, Carbon dioxide,** processes
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(supercrit.; method of undercutting micromech. device with supercrit. **carbon dioxide**)

IT **143780-02-3,** 1,1-Dihydroperfluorooctyl acrylate styrene copolymer
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(surfactant; method of undercutting micromech. device with supercrit. **carbon dioxide**)

IT **124-38-9, Carbon dioxide,** processes
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(supercrit.; method of undercutting micromech. device with supercrit. **carbon dioxide**)

RN 124-38-9 HCAPLUS

CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



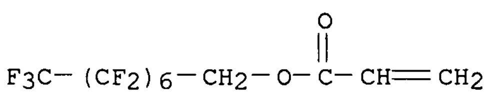
IT **143780-02-3,** 1,1-Dihydroperfluorooctyl acrylate styrene copolymer
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical

process); PYP (Physical process); PROC (Process); USES (Uses)
(surfactant; method of undercutting micromech. device with supercrit. **carbon dioxide**)

RN 143780-02-3 HCAPLUS
CN 2-Propenoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with ethenylbenzene (9CI) (CA INDEX NAME)

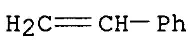
CM 1

CRN 307-98-2
CMF C11 H5 F15 O2



CM 2

CRN 100-42-5
CMF C8 H8



L67 ANSWER 3 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 2003:381076 HCAPLUS
DN 138:346375
TI Processing fluorinated **photoresists** in supercritical **CO_2** : environmentally responsible processes for the computer industry
AU Pham, Victor Q.; Weibel, Gina L.; Hamad, Alyssandrea H.; Ober, Christopher K.
CS Dep. Materials Science and Engineering, Cornell Univ., Ithaca, NY, 14853-1501, USA
SO Polymeric Materials Science and Engineering (2001), 84, 49-50
CODEN: PMSEDG; ISSN: 0743-0515
PB American Chemical Society
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
AB Supercrit. fluid **carbon dioxide** (SF-**CO_2**) has recently gained acceptance as a prime candidate for environmentally benign **photoresist** processing. The various benefits of SF-**CO_2** include adjustable solvent strength to tailor selectivity and yields, higher diffusion coeff. and lower viscosity than common solvents and rapid diffusion of **CO_2** through condensed phases such as polymers. The authors study entails investigating the patterning of a chem. amplified, SF-**CO_2** developable fluorinated **photoresist** based on a block copolymer of tetrahydropyranyl methacrylate (THPMA) and 1H,1H-perfluorooctyl methacrylate (FMA). In one focus, higher feature resoln. limits are being pursued through improved irradn. methods and processing conditions. With this neg. tone chem. amplified **photoresist** system, line and space-patterns have been produced

down to 100 nm, by exposures to both ArF (193 nm) and electron-beam radiation. The authors recent results show that **CO2** indeed can be used effectively as an environmentally benign solvent in **photoresist** processing. Further research to optimize current processing conditions is almost certain to yield features with significantly greater resolns. and higher aspect ratios. The dissoln. rate monitoring system, while nascent, is potentially a powerful tool to elucidate a plethora of information in supercrit. fluid processing.

ST processing fluorinated lithog **photoresist** supercrit **carbon dioxide**

IT Electron beam resists
Photoresists
(chem. amplified; processing with supercrit. **CO2** of chem. amplified resist based on tetrahydropyranyl methacrylate-perfluorooctyl methacrylate block copolymer and patterned with ArF laser or electron-beam)

IT Supercritical fluids
(processing with supercrit. **CO2** of chem. amplified resist based on tetrahydropyranyl methacrylate-perfluorooctyl methacrylate block copolymer and patterned with ArF laser or electron-beam)

IT **124-38-9, Carbon dioxide,** processes
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process)
(processing with supercrit. **CO2** of chem. amplified resist based on tetrahydropyranyl methacrylate-perfluorooctyl methacrylate block copolymer and patterned with ArF laser or electron-beam)

IT **212389-71-4,** 1H,1H-Perfluorooctyl methacrylate-2-tetrahydropyranyl methacrylate block copolymer
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(processing with supercrit. **CO2** of chem. amplified resist based on tetrahydropyranyl methacrylate-perfluorooctyl methacrylate block copolymer and patterned with ArF laser or electron-beam)

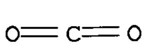
RE.CNT 9 THERE ARE 9 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE
(1) Kirby, C; Chem Rev 1999, V99, P565 HCAPLUS
(2) O'Neil, M; Ind Eng Chem Res 1998, V37, P3067
(3) Perry, R; Chemical engineering handbook 1997, P22.14
(4) Rodriguez, R; Solid State Technol 1985, V28(5), P125
(5) Sundararajan, N; Chem Mater 2000, V12(1), P41 HCAPLUS
(6) Sundararajan, N; J Photopolym Sci Technol 1999, V12(3), P457 HCAPLUS
(7) Taylor, G; Chem Mater 1991, V3, P1031 HCAPLUS
(8) Weibel, G; Polym Prepr 2000, V41(2), P1838 HCAPLUS
(9) Yang, S; Chem Mater 2000, V12(1), P33 HCAPLUS

IT **124-38-9, Carbon dioxide,** processes
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process)
(processing with supercrit. **CO2** of chem. amplified resist based on tetrahydropyranyl methacrylate-perfluorooctyl methacrylate block copolymer and patterned with ArF laser or electron-beam)

RN 124-38-9 HCAPLUS

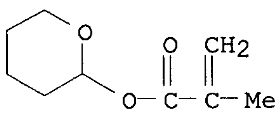
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



IT **212389-71-4**, 1H,1H-Perfluorooctyl methacrylate-2-tetrahydropyranyl methacrylate block copolymer
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(processing with supercrit. **CO2** of chem. amplified resist based on tetrahydropyranyl methacrylate-perfluorooctyl methacrylate block copolymer and patterned with ArF laser or electron-beam)
RN 212389-71-4 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate, block (9CI) (CA INDEX NAME)

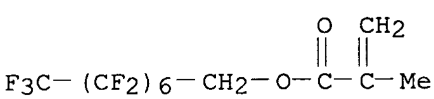
CM 1

CRN 52858-59-0
CMF C9 H14 O3



CM 2

CRN 3934-23-4
CMF C12 H7 F15 O2



L67 ANSWER 4 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 2002:799487 HCAPLUS
DN 139:92646
TI Spin coating and photolithography using liquid and supercritical **carbon dioxide**
AU Hoggan, Erik N.; Flowers, Devin; DeSimone, Joseph M.; Carbonell, Ruben G.
CS Dep. Chem. Eng., North Carolina State Univ., Raleigh, NC, USA
SO Proceedings of SPIE-The International Society for Optical Engineering (2002), 4690(Pt. 2, Advances in Resist Technology and Processing XIX), 1217-1223
CODEN: PSISDG; ISSN: 0277-786X
PB SPIE-The International Society for Optical Engineering
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
AB We discuss a new dry lithog. process using only **carbon dioxide** (**CO2**) as a solvent. Novel **CO2** sol. **photoresists** were synthesized based on random copolymers of poly(1,1-dihydroperfluorooctyl)methacrylate 2-tetrahydropyranyl

methacrylate. **Photoresist** spin casting, development, and stripping were all carried out in either liq. or supercrit. **CO2**. We investigate such parameters as resist sensitivity, contrast, and resoln. The contrast of these resists has been evaluated using 248 nm exposures, and promising test images have been formed.

ST spin coating photolithog liq supercrit **carbon dioxide**

IT Photolithography
Photoresists
(spin coating and photolithog. using liq. and supercrit. **carbon dioxide**)

IT Coating process
(spin; spin coating and photolithog. using liq. and supercrit. **carbon dioxide**)

IT Solvents
(supercrit.; spin coating and photolithog. using liq. and supercrit. **carbon dioxide**)

IT 168153-15-9, Diphenyliodonium tetrakis[3,5-bis(trifluoromethyl)phenyl]borate
RL: TEM (Technical or engineered material use); USES (Uses)
(ionic photoacid generator; spin coating and photolithog. using liq. and supercrit. **carbon dioxide**)

IT 457632-31-4
RL: TEM (Technical or engineered material use); USES (Uses)
(nonionic photoacid generator; spin coating and photolithog. using liq. and supercrit. **carbon dioxide**)

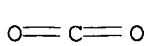
IT **124-38-9, Carbon dioxide,** uses
256430-22-5
RL: TEM (Technical or engineered material use); USES (Uses)
(spin coating and photolithog. using liq. and supercrit. **carbon dioxide**)

RE.CNT 10 THERE ARE 10 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE
(1) Bornside, D; J Appl Phys 1993, V73(2) HCAPLUS
(2) Cooper, A; Journal of Materials Chemistry 2000, V10(2), P207 HCAPLUS
(3) DeSimone, J; Cleaning process using carbon dioxide as a solvent and employing molecularly engineered surfactants 1999
(4) DeSimone, J; Science 1992, V257, P945 HCAPLUS
(5) Kunz, R; J Vac Sci Technol B 1999, V17(6), P3267 HCAPLUS
(6) McHugh, M; Supercritical Fluid Extraction: Principle and Practice. 2nd ed 1994
(7) Namatsu, H; J Vac Sci Technol B 2000, V18(2), P780 HCAPLUS
(8) Ober, C; Advanced Materials 1997, V9(13), P1039 HCAPLUS
(9) Span, R; J Phys Chem Ref Data 1996, P1509 HCAPLUS
(10) Toriumi, M; J Vac Sci Technol B 2000, V18(6), P3328 HCAPLUS

IT **124-38-9, Carbon dioxide,** uses
256430-22-5
RL: TEM (Technical or engineered material use); USES (Uses)
(spin coating and photolithog. using liq. and supercrit. **carbon dioxide**)

RN 124-38-9 HCAPLUS
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)

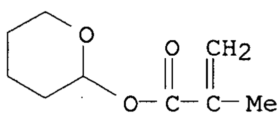


RN 256430-22-5 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-

pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl
2-methyl-2-propenoate (9CI) (CA INDEX NAME)

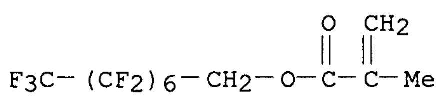
CM 1

CRN 52858-59-0
CMF C9 H14 O3



CM 2

CRN 3934-23-4
CMF C12 H7 F15 O2



L67 ANSWER 5 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 2002:799403 HCAPLUS
DN 138:328885
TI Dissolution rate measurements for resist processing in supercritical **carbon dioxide**
AU Pham, Victor Quan; Weibel, Gina L.; Rao, Nagesh G.; Ober, Christopher Kemper
CS Sch. Chem. Biomol. Eng., Cornell Univ., Ithaca, NY, 14853, USA
SO Proceedings of SPIE-The International Society for Optical Engineering (2002), 4690(Pt. 1, Advances in Resist Technology and Processing XIX), 425-431
CODEN: PSISDG; ISSN: 0277-786X
PB SPIE-The International Society for Optical Engineering
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
AB A dissoln. rate monitor (DRM) was successfully constructed to study the behavior of thin **photoresist** films undergoing the dissoln. process in supercrit. **carbon dioxide** (SCCO2). The DRM is based on the principles of interferometry but requires special modifications to the processing vessel to allow for the passage of transmitted and reflected He-Ne laser light. Dissoln. rates obtained agree well with independent profilometric measurements of film thickness loss. The authors found that for block- and random copolymers of tetrahydropyranyl methacrylate (THPMA) and perfluorooctyl methacrylate (F7MA) dissoln. rates vary with film thickness, slowing down considerably towards the silicon surface. This behavior was also obsd. in tert-Bu methacrylate (TBMA)-F7MA random copolymers.
ST dissoln rate measurements **photoresist** processing supercrit

carbon dioxide; interferometric dissoln rate monitor
photoresist dissoln supercrit **carbon dioxide**

IT Polymers, properties
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PYP (Physical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(block; interferometric dissoln. rate monitor to study thin **photoresist** films undergoing dissoln. process in supercrit. **carbon dioxide**)

IT Laser interferometry
Photoresists
Supercritical fluids
(interferometric dissoln. rate monitor to study thin **photoresist** films undergoing dissoln. process in supercrit. **carbon dioxide**)

IT Dissolution
(kinetics; interferometric dissoln. rate monitor to study thin **photoresist** films undergoing dissoln. process in supercrit. **carbon dioxide**)

IT **212389-71-4,** 1H,1H-Perfluorooctyl methacrylate-2-tetrahydropyranyl methacrylate block copolymer **246045-92-1,** Tert-Butyl methacrylate-1H,1H-Perfluorooctyl methacrylate copolymer **256430-22-5,** 1H,1H-Perfluorooctyl methacrylate-tetrahydropyranyl methacrylate copolymer
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PYP (Physical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(interferometric dissoln. rate monitor to study thin **photoresist** films undergoing dissoln. process in supercrit. **carbon dioxide**)

IT **124-38-9, Carbon dioxide,** processes
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process)
(supercrit.; interferometric dissoln. rate monitor to study thin **photoresist** films undergoing dissoln. process in supercrit. **carbon dioxide**)

RE.CNT 13 THERE ARE 13 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

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(2) Cooper, W; Polymer 1985, V26(7), P1069 HCAPLUS
(3) Krasicky, P; Chem Eng Commun 1987, V54(1-6), P279 HCAPLUS
(4) Krasicky, P; J Appl Polym Sci 1988, V35(3), P641 HCAPLUS
(5) Krasicky, P; Polym Eng Sci 1987, V27(4), P282 HCAPLUS
(6) Lewis, H; Chem Vap Deposition 2001, V7(5), P195 HCAPLUS
(7) McAdams, C; Advances in Resist Technology and Processing 18
(8) McAdams, C; Proc SPIE-Int Soc Opt Eng 2001, V4345, P327 HCAPLUS
(9) Pham, V; Abstr Pap - Am Chem Soc 2001, V221st, PPMSE-027 HCAPLUS
(10) Rodriguez, F; Solid State Technol 1985, V28(5), P125 HCAPLUS
(11) Sundararajan, N; Advances in Resist Technology and Processing 16
(12) Sundararajan, N; Proc SPIE-Int Soc Opt Eng 1999, V3678, P78 HCAPLUS
(13) Yang, S; Polym Mater Sci Eng 1999, V81, P481 HCAPLUS

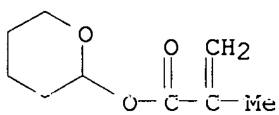
IT **212389-71-4,** 1H,1H-Perfluorooctyl methacrylate-2-tetrahydropyranyl methacrylate block copolymer **246045-92-1,** Tert-Butyl methacrylate-1H,1H-Perfluorooctyl methacrylate copolymer **256430-22-5,** 1H,1H-Perfluorooctyl methacrylate-tetrahydropyranyl methacrylate copolymer
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PYP (Physical process); TEM (Technical or engineered material use); PROC

(Process); USES (Uses)
(interferometric dissoln. rate monitor to study thin **photoresist** films undergoing dissoln. process in supercrit. **carbon dioxide**)

RN 212389-71-4 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate, block (9CI) (CA INDEX NAME)

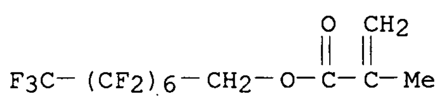
CM 1

CRN 52858-59-0
CMF C9 H14 O3



CM 2

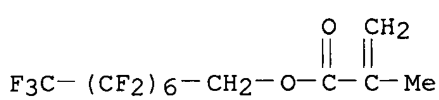
CRN 3934-23-4
CMF C12 H7 F15 O2



RN 246045-92-1 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 1,1-dimethylethyl ester, polymer with 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

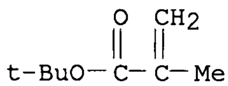
CM 1

CRN 3934-23-4
CMF C12 H7 F15 O2



CM 2

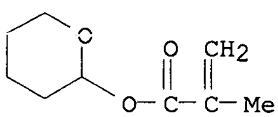
CRN 585-07-9
CMF C8 H14 O2



RN 256430-22-5 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

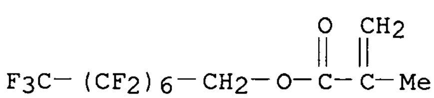
CM 1

CRN 52858-59-0
CMF C9 H14 O3

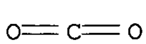


CM 2

CRN 3934-23-4
CMF C12 H7 F15 O2



IT **124-38-9, Carbon dioxide,** processes
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process)
(supercrit.; interferometric dissoln. rate monitor to study thin **photoresist** films undergoing dissoln. process in supercrit. **carbon dioxide**)
RN 124-38-9 HCAPLUS
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



L67 ANSWER 6 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 2002:799402 HCAPLUS
DN 139:44109
TI Designing **photoresist** systems for **CO2**-based microlithography
AU Flowers, Devin; Hoggan, Erik N.; Carbonell, Ruben G.; DeSimone, Joseph M.
CS Dep. Chem., Univ. of North Carolina/Chapel Hill, Chapel Hill, NC, 27599, USA
SO Proceedings of SPIE-The International Society for Optical Engineering

(2002), 4690(Pt. 1, Advances in Resist Technology and Processing XIX), 419-424
CODEN: PSISDG; ISSN: 0277-786X
PB SPIE-The International Society for Optical Engineering
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
AB **Carbon dioxide** (**CO2**) based microlithog. (dry microlithog.) represents an immense opportunity for the semiconductor industry to keep pace with Moore's Law while reducing its environmental impact. Currently, rinsing <130-nm developed images with supercrit. **CO2** is the only method which can prevent image collapse at this resoln. In this article, we will discuss **CO2**'s ability to improve lithog. performance as we demonstrate its potential to replace the most solvent intensive steps of the microlithog. process; spin coating, developing, and stripping. During these steps, semiconductor manufacturers produce vast amts. of org. and aq. waste, which are detrimental to our ecosystem. However, before **CO2** can replace conventional solvents, **photoresist** systems must be designed and synthesized to be compatible with **CO2**. These **photoresists** must be sol. in liq. **CO2** to insure that uniform thin-films can be produced by spin coating while maintaining characteristics of conventional resist systems such as low absorbance, high sensitivity, soly. contrast, good resoln., and etch resistance. Using our **CO2** compatible resist system, we will show the ability of **CO2** to spin coat uniform thin-films which (after exposing and PEB) can be developed using scCO2 to produce lithog. features that may be stripped in **CO2**. Thus, revealing the enormous potential of **CO2** to provide the microlithog. industry an opportunity to escape its water and org. solvent dependence.
ST designing **photoresist** system **carbon dioxide** microlithog
IT Lithography
Photoresists
(designing **photoresist** systems for **CO2**-based microlithog.)
IT 168153-15-9 457632-31-4
RL: MOA (Modifier or additive use); USES (Uses)
(designing **photoresist** systems for **CO2**-based microlithog.)
IT **246045-92-1 256430-22-5**
RL: TEM (Technical or engineered material use); USES (Uses)
(designing **photoresist** systems for **CO2**-based microlithog.)
IT **124-38-9, Carbon dioxide,** uses
RL: NUU (Other use, unclassified); USES (Uses)
(liq.; designing **photoresist** systems for **CO2**-based microlithog.)
RE.CNT 12 THERE ARE 12 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE
(1) Anon; J Appl Phys 1993, V32, P6059
(2) DeSimone, J; US 5739223 HCAPLUS
(3) DeSimone, J; Science 1992, V257, P945 HCAPLUS
(4) Goldfarb, D; J Vac Sci Technol B 2000, V18(6), P3313 HCAPLUS
(5) Houlihan, F; Chem Mater 1991, V3, P462 HCAPLUS
(6) Kunz, R; J Vac Sci Technol B 1999, V17(6), P3267 HCAPLUS
(7) Mason, M; Sematech Next Generation Lithography Workshop 1998

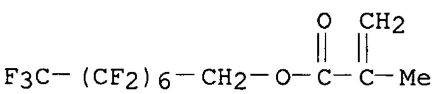
(8) McAdams, C; Submitted to Proc SPIE Int Soc Opt Eng 2001, P4345
(9) Moore, G; Proc SPIE Int Soc Opt Eng 1994, V2438, P2
(10) Okoroanyanwu, U; J Vac Sci Technol B 2000, V18(6), P3381 HCAPLUS
(11) SEMI; SEMI E10-96
(12) Sundararajan, N; Chem Mater 2000, V12, P41 HCAPLUS

IT **246045-92-1 256430-22-5**
RL: TEM (Technical or engineered material use); USES (Uses)
(designing **photoresist** systems for **CO2**-based microlithog.)

RN 246045-92-1 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 1,1-dimethylethyl ester, polymer with 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

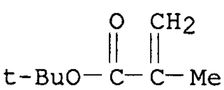
CM 1

CRN 3934-23-4
CMF C12 H7 F15 O2



CM 2

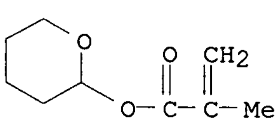
CRN 585-07-9
CMF C8 H14 O2



RN 256430-22-5 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

CM 1

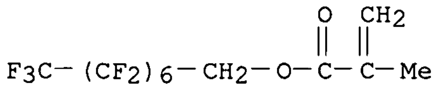
CRN 52858-59-0
CMF C9 H14 O3



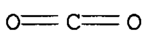
CM 2

CRN 3934-23-4

CMF C12 H7 F15 O2



IT **124-38-9, Carbon dioxide,** uses
RL: NUU (Other use, unclassified); USES (Uses)
(liq.; designing **photoresist** systems for **CO2**-based microlithog.)
RN 124-38-9 HCAPLUS
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



L67 ANSWER 7 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 2002:624867 HCAPLUS
DN 137:390987
TI Positive-tone resist for supercritical **CO2** processing
AU Pham, Victor Q.; Nguyen, Peter T.; Weibel, Gina L.; Ferris, Robert J.; Ober, Christopher K.
CS School of Chemical and Biomolecular Eng., Cornell Univ., Ithaca, NY, 14853, USA
SO Polymer Preprints (American Chemical Society, Division of Polymer Chemistry) (2002), 43(2), 885-886
CODEN: ACPPAY; ISSN: 0032-3934
PB American Chemical Society, Division of Polymer Chemistry
DT Journal; (computer optical disk)
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
AB The authors created a pos.-tone **CO2** developable lithog. resist by image reversal in neg. chem. amplification **photoresist** via silylation with hexamethyldisilazane. Rutherford backscattering spectroscopy was used to understand the diffusion process as well as to obtain essential information such as depth concn. profiles of Si-contg. mols. The authors showed image reversal with large samples. Image reversal at micron and sub-micron length-scales is inherently more challenging since it involves process optimization in a large, multidimensional parameter space. However, the results obtained to date seem to suggest that such is a strong possibility in the foreseeable future.
ST pos **carbon dioxide** development resist image reversal silylation **photoresist**
IT Polymers, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PYP (Physical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(block; pos. **CO2** developable resist created by image reversal via. amplification and silylation from deep-UV exposed neg. methacrylate copolymer **photoresist**)
IT Negative **photoresists**
(image reversal; pos. **CO2** developable resist created by image

reversal via. amplification and silylation from deep-UV exposed neg. methacrylate copolymer **photoresist**)

IT IR spectra
Positive **photoresists**
Rutherford backscattering
(pos. **CO2** developable resist created by image reversal via. amplification and silylation from deep-UV exposed neg. methacrylate copolymer **photoresist**)

IT **212389-71-4**
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PYP (Physical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(pos. **CO2** developable resist created by image reversal via. amplification and silylation from deep-UV exposed neg. methacrylate copolymer **photoresist**)

IT 999-97-3, Hexamethyldisilazane
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)
(silylating agent; pos. **CO2** developable resist created by image reversal via. amplification and silylation from deep-UV exposed neg. methacrylate copolymer **photoresist**)

IT **124-38-9, Carbon dioxide,** processes
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process)
(supercrit., developer; pos. **CO2** developable resist created by image reversal via. amplification and silylation from deep-UV exposed neg. methacrylate copolymer **photoresist**)

RE.CNT 8 THERE ARE 8 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE
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(2) Goldfarb, D; J Vac Sci Teehnol, B 2000, V18(6), P3313 HCAPLUS
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(4) Pham, V; Abstr Pap - Am Chem Soc 2001, 221st PMSE-027
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(7) Sundararajan, N; Chem Mater 2000, V12(1), P41 HCAPLUS
(8) Yang, S; Polym Mater Sci Eng 1999, V81, P481 HCAPLUS

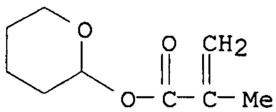
IT **212389-71-4**
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PYP (Physical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(pos. **CO2** developable resist created by image reversal via. amplification and silylation from deep-UV exposed neg. methacrylate copolymer **photoresist**)

RN 212389-71-4 HCAPLUS

CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate, block (9CI) (CA INDEX NAME)

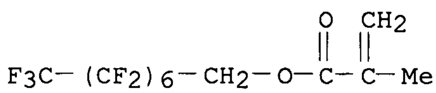
CM 1

CRN 52858-59-0
CMF C9 H14 O3

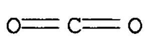


CM 2

CRN 3934-23-4
CMF C12 H7 F15 O2



IT **124-38-9, Carbon dioxide,** processes
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process)
(supercrit., developer; pos. **CO2** developable resist created by image reversal via. amplification and silylation from deep-UV exposed neg. methacrylate copolymer **photoresist**)
RN 124-38-9 HCAPLUS
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



L67 ANSWER 8 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 2002:591965 HCAPLUS
DN 137:147754
TI Polymers and their use in resists and pattern formation
IN Hatakeyama, Jun; Harada, Yuji; Watanabe, Atsushi; Sasako, Masaru; Endo, Masataka; Kishimura, Shinji; Otani, Michitaka; Miyazawa, Satoru; Tsutsumi, Kentaro; Maeda, Kazuhiko
PA Shin-Etsu Chemical Industry Co., Ltd., Japan; Matsushita Electric Industrial Co., Ltd.; Central Glass Co., Ltd.
SO Jpn. Kokai Tokkyo Koho, 34 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
IC ICM C08F212-04
ICS C08F216-14; C08F220-26; G03F007-004; G03F007-039; G03F007-38; H01L021-027
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
Section cross-reference(s): 37
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 2002220416	A2	20020809	JP 2001-346933	20011113
PRAI	JP 2000-353878	A	20001121		

AB The polymers have repeating units of [CR1(C6(CF3)dFe(OH)fH5-d-e-f)CR2R3]a,

[CR1(C6(CF3)gFhH5-g-h)CR2R3]b, and [CR4(XR5CR6R7OR8)CH2]c [R1, R2, R3 = H, F, linear, cyclic or branched C1-10 (un)fluorinated alkyl; R4 = H, C1-4 alkyl; R5 = single bond, linear, branched, or cyclic C1-10 alkylene; R6, R7 = F, R4; R6 and/or R7 contains .gtoreq.1 F; X = O, **CO2**; R8 = acid-unstable group; 0 .ltoreq. d < 5; 0 .ltoreq. e < 5; 0 < f < 5; g, h = 0-5; 0 < d + e < 5; 0 < g + h .ltoreq. 5; 0 .ltoreq. a/(a + b + c) < 1; 0 .ltoreq. b/(a + b + c) < 1; 0 < (a + b)/(a + b + c) <1; 0 < c/(a + b + c) < 0.8]. Resists contg. the polymers or chem.-amplified pos.-working resists contg. the polymers, org. solvents, acid generators, and optionally basic compds. and/or dissoln. inhibitors, are claimed. A pattern is formed by applying the resists on a substrate, heating, exposing with .ltoreq.300 nm-high-energy rays or electron beam through a photomask, heating optionally, and developing with a soln. The exposure wavelength may be 100-180 nm-vacuum UV ray or 1-30 nm-soft x-ray or electron beam. The resists show high sensitivity and resoln. to .ltoreq.190 nm-energy rays and plasma etching resistance.

ST fluoropolymer resist pattern formation high energy ray; chem amplified pos working resist fluoropolymer; resist fluoropolymer electron beam x ray UV exposure; fluorinated styrene deriv acrylic polymer **photoresist**; acid unstable group polymer **photoresist**

IT Positive **photoresists**
(UV; polymers having fluorinated styrene deriv. units and acid-unstable groups for pos.-working resists and pattern formation)

IT Fluoropolymers, preparation
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(polymers having fluorinated styrene deriv. units and acid-unstable groups for pos.-working resists and pattern formation)

IT Electron beam resists
X-ray resists
(pos.-working; polymers having fluorinated styrene deriv. units and acid-unstable groups for pos.-working resists and pattern formation)

IT 194999-85-4 258342-00-6
RL: CAT (Catalyst use); USES (Uses)
(acid generator; polymers having fluorinated styrene deriv. units and acid-unstable groups for pos.-working resists and pattern formation)

IT 139254-88-9
RL: MOA (Modifier or additive use); USES (Uses)
(dissoln. inhibitor; polymers having fluorinated styrene deriv. units and acid-unstable groups for pos.-working resists and pattern formation)

IT **445000-03-3P** **445000-05-5P** **445000-07-7P**
445000-10-2P **445000-12-4P** 445000-15-7P
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(polymers having fluorinated styrene deriv. units and acid-unstable groups for pos.-working resists and pattern formation)

IT 102-71-6, Triethanolamine, uses 102-82-9, Tributylamine 211919-60-7
RL: MOA (Modifier or additive use); USES (Uses)
(polymers having fluorinated styrene deriv. units and acid-unstable groups for pos.-working resists and pattern formation)

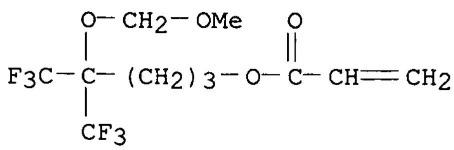
IT **445000-03-3P** **445000-05-5P** **445000-07-7P**
445000-10-2P **445000-12-4P**
RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(polymers having fluorinated styrene deriv. units and acid-unstable groups for pos.-working resists and pattern formation)

RN 445000-03-3 HCAPLUS

CN 2-Propenoic acid, 5,5,5-trifluoro-4-(methoxymethoxy)-4-(trifluoromethyl)pentyl ester, polymer with 4-ethenyl-3,5-difluorophenol and 4-ethenylphenol (9CI) (CA INDEX NAME)

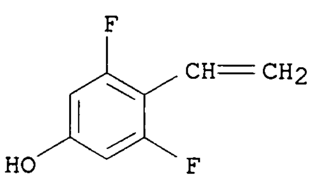
CM 1

CRN 445000-02-2
CMF C11 H14 F6 O4



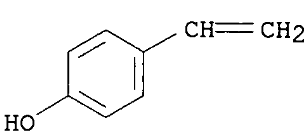
CM 2

CRN 293753-16-9
CMF C8 H6 F2 O



CM 3

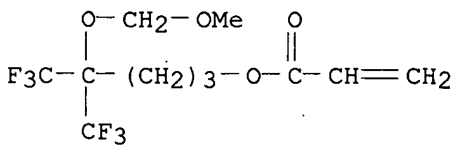
CRN 2628-17-3
CMF C8 H8 O



RN 445000-05-5 HCAPLUS
CN 2-Propenoic acid, 5,5,5-trifluoro-4-(methoxymethoxy)-4-(trifluoromethyl)pentyl ester, polymer with ethenylpentafluorobenzene and 4-ethenylphenol (9CI) (CA INDEX NAME)

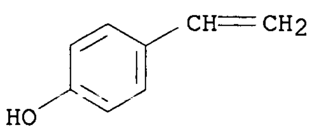
CM 1

CRN 445000-02-2
CMF C11 H14 F6 O4



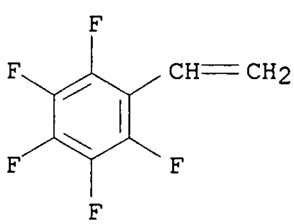
CM 2

CRN 2628-17-3
CMF C8 H8 O



CM 3

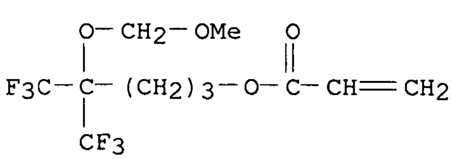
CRN 653-34-9
CMF C8 H3 F5



RN 445000-07-7 HCAPLUS
CN 2-Propenoic acid, 5,5,5-trifluoro-4-(methoxymethoxy)-4-(trifluoromethyl)pentyl ester, polymer with 4-ethenyl-3,5-difluorophenol (9CI) (CA INDEX NAME)

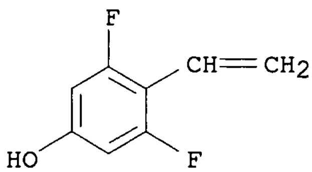
CM 1

CRN 445000-02-2
CMF C11 H14 F6 O4



CM 2

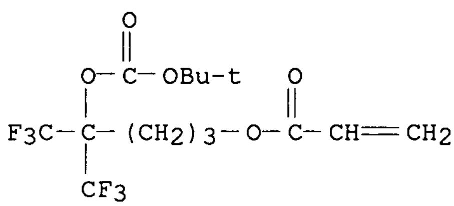
CRN 293753-16-9
CMF C8 H6 F2 O



RN 445000-10-2 HCAPLUS
CN 2-Propenoic acid, 4-[[(1,1-dimethylethoxy)carbonyl]oxy]-5,5,5-trifluoro-4-(trifluoromethyl)pentyl ester, polymer with 4-ethenyl-3,5-difluorophenol (9CI) (CA INDEX NAME)

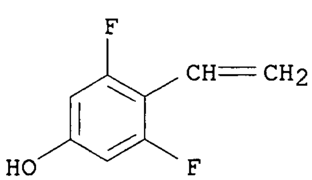
CM 1

CRN 445000-09-9
CMF C14 H18 F6 O5



CM 2

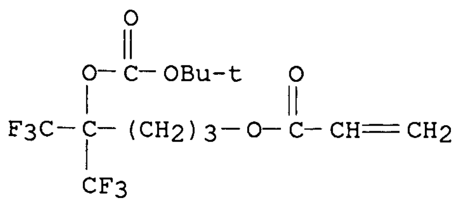
CRN 293753-16-9
CMF C8 H6 F2 O



RN 445000-12-4 HCAPLUS
CN 2-Propenoic acid, 4-[[(1,1-dimethylethoxy)carbonyl]oxy]-5,5,5-trifluoro-4-(trifluoromethyl)pentyl ester, polymer with 4-ethenyl-2,3-difluorophenol (9CI) (CA INDEX NAME)

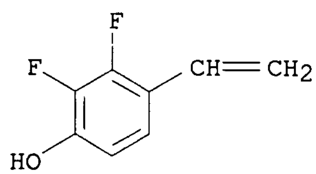
CM 1

CRN 445000-09-9
CMF C14 H18 F6 O5



CM 2

CRN 343305-64-6
CMF C8 H6 F2 O

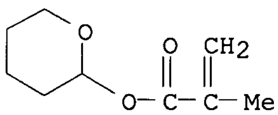


L67 ANSWER 9 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 2002:560009 HCAPLUS
DN 137:255195
TI Totally "dry" microlithography in **carbon dioxide**
AU Flowers, Devin; Hoggan, Erik; Carbonell, Ruben G.; DeSimone, Joseph M.
CS Department of Chemistry, Venable and Kenan Laboratories CB #3290, University of North Carolina at Chapel Hill, Chapel Hill, NC, 27599, USA
SO Polymeric Materials Science and Engineering (2002), 87, 409-410
CODEN: PMSEDG; ISSN: 0743-0515
PB American Chemical Society
DT Journal; (computer optical disk)
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
Section cross-reference(s): 60, 76
AB The conventional manufg. of integrated circuits utilizes three solvent intensive steps: spin coating, developing, and stripping of **photoresist** materials. This process drains local water supplies and leads to the prodn. enormous amts. of org. and aq. waste streams each day. The health and environmental hazards posed by these solvents has led to increased research on alternative processing solvents. **Carbon dioxide** (**CO2**) is a promising alternative because it is non-toxic, non-flammable, inexpensive, environmentally benign, and easily recyclable. The present work shows that **CO2** can be used to replace org. and aq. solvent in each step of the microlithog. process. It is shown that **CO2** can be used to spin coat thin films for 193 nm resist system. Also, that this resin when formulated with an ionic PAG could be exposed to produce images which were developed and stripped in **CO2**. This work further demonstrates the potential of **CO2** to continue Moore's Law into 157 nm lithog. by enhancing performance without destroying environment.
ST totally dry microlithog photolithog UV **carbon dioxide**

processing solvent
IT Photolithography
(UV; totally dry microlithog. in **carbon dioxide**)
IT Semiconductor device fabrication
(totally dry microlithog. in **carbon dioxide** in relation to)
IT 460053-36-5P 460053-37-6P
RL: PNU (Preparation, unclassified); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)
(in prepn. of photoacid generators)
IT 94-36-0, Benzoyl peroxide, reactions 128-08-5, N-Bromosuccinimide 355-43-1, Perfluorohexyl iodide 1483-72-3, Diphenyl iodonium chloride 16836-95-6, Silver tosylate 55289-35-5, 6-Bromo-2-nitrotoluene 79060-88-1
RL: RCT (Reactant); RACT (Reactant or reagent)
(in prepn. of photoacid generators)
IT 168153-15-9P
RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(ionic photoacid generator; totally dry microlithog. in **carbon dioxide**)
IT 457632-31-4P, 2-Perfluorohexyl-6-nitrobenzyl tosylate
RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(nonionic photoacid generator; totally dry microlithog. in **carbon dioxide**)
IT **256430-22-5P**
RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(**photoresist** polymer; totally dry microlithog. in **carbon dioxide**)
IT **124-38-9, Carbon dioxide,** uses
RL: TEM (Technical or engineered material use); USES (Uses)
(totally dry microlithog. in **carbon dioxide**)
RE.CNT 5 THERE ARE 5 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE
(1) DeSimone, J; Macromolecules 1993, V26, P2663
(2) DeSimone, J; Macromolecules 1994, V27, P5527
(3) DeSimone, J; Science 1992, V257, P945 HCAPLUS
(4) Kunz, R; J Vac Sci Technol B 1999, V17(6), P3267 HCAPLUS
(5) Tanaka; J Appl Phys 1993, V32, P6059 HCAPLUS
IT **256430-22-5P**
RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(**photoresist** polymer; totally dry microlithog. in **carbon dioxide**)
RN 256430-22-5 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

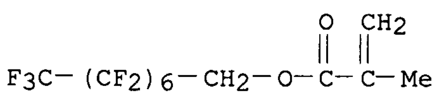
CM 1

CRN 52858-59-0
CMF C9 H14 O3

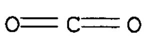


CM 2

CRN 3934-23-4
CMF C12 H7 F15 O2



IT 124-38-9, **Carbon dioxide**, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(totally dry microlithog. in **carbon dioxide**)
RN 124-38-9 HCAPLUS
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



L67 ANSWER 10 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 2002:559904 HCAPLUS
DN 137:286272
TI Alicyclic **photoresists** for **CO2**-based microlithography at 157 nm
AU Boggiano, Mary Kate; DeSimone, Joseph
CS Chemistry Department, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA
SO Polymeric Materials Science and Engineering (2002), 87, 207-208
CODEN: PMSEDG; ISSN: 0743-0515
PB American Chemical Society
DT Journal; (computer optical disk)
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
Section cross-reference(s): 37, 38
AB Various methods of copolymn. have been explored in an attempt to find routes to **photoresists** for 157 nm lithog. using **CO2** processing. Copolymers formed from vinyl monomers and sulfur dioxide have potential as chain scission resists, while addn. polymn. of alicyclic norbornene derivs. has yielded polymers which could be used as chem. amplification resists. The use of alicyclic monomers should help reduce absorption at 157 nm, increase thermal stability, and increase etch resistance.
ST polysulfone norbornene sulfur dioxide copolymer resist **photoresist** photolithog; **carbon dioxide** processing lithog
polysulfone norbornene sulfur dioxide resist
IT Polysulfones, properties

RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(prepn. and properties of alicyclic and sulfur dioxide-based copolymers for **CO2**-based microlithog. at 157 nm)

IT 183617-50-7P
RL: PNU (Preparation, unclassified); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)
(in prepn. of alicyclic and sulfur dioxide-based copolymers for **CO2**-based microlithog.)

IT **307-98-2** 542-92-7, Cyclopentadiene, reactions 7446-09-5, Sulfur dioxide, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(in prepn. of alicyclic and sulfur dioxide-based copolymers for **CO2**-based microlithog.)

IT 56725-07-6P 464188-86-1P
RL: PNU (Preparation, unclassified); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(prepn. and properties of alicyclic and sulfur dioxide-based copolymers for **CO2**-based microlithog. at 157 nm)

IT 26936-16-3P, Decanoic acid, bicyclo[2.2.1]hept-5-en-2-ylmethyl ester, homopolymer 183617-51-8P 464188-87-2P 464188-88-3P 464892-71-5P 464892-93-1P
RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(prepn. and properties of alicyclic and sulfur dioxide-based copolymers for **CO2**-based microlithog. at 157 nm)

RE.CNT 10 THERE ARE 10 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE
(1) Breunig, S; Makromol Chem 1992, V193, P2915 HCAPLUS
(2) Desimone, J; Science 1992, V257, P945 HCAPLUS
(3) Goldfarb, D; J Vac Sci Technol B 2000, V18, P3313 HCAPLUS
(4) Hoggan, E; Polym Mater Sci Eng 1999, V81, P47 HCAPLUS
(5) Ito, H; ACS Symp Ser 1998, V706(Micro- and Nanopatterning Polymers), P208
(6) Kunz, R; J Vac Sci Technol B 1999, V17, P3267 HCAPLUS
(7) Mathew, J; Macromolecules 1996, V29, P2755 HCAPLUS
(8) Okoroanyanwu, U; J Molec Cat A 1998, V133, P93 HCAPLUS
(9) Otsuki, T; J Polym Sci A 2000, V38, P4661 HCAPLUS
(10) Sundararajan, N; Chem Mater 2000, V12, P41 HCAPLUS

IT **307-98-2**
RL: RCT (Reactant); RACT (Reactant or reagent)
(in prepn. of alicyclic and sulfur dioxide-based copolymers for **CO2**-based microlithog.)

RN 307-98-2 HCAPLUS

CN 2-Propenoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8-pentadecafluorooctyl ester (9CI) (CA INDEX NAME)

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                           O
                           ||
F3C— (CF2)6— CH2— O— C— CH══CH2
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L67 ANSWER 11 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN

AN 2002:501667 HCAPLUS

DN 137:224024

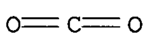
TI Designing **photoresist** systems for microlithography in **carbon dioxide**

AU Flowers, Devin; Hoggan, Erik; DeSimone, Joseph M.; Carbonell, Ruben
CS Department of Chemistry, University of North Carolina at Chapel Hill, Chapel Hill, NC, 27599, USA
SO Materials Research Society Symposium Proceedings (2002), 705(Nanopatterning: From Ultralarge-Scale Integration to Biotechnology), 81-87
CODEN: MRSPDH; ISSN: 0272-9172
PB Materials Research Society
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
AB Currently, the microlithog. industry creates large amts. of org. and aq. wastes in the prodn. of semiconductors. Using **carbon dioxide** can possibly eliminate the majority of these waste solvents as well as eliminate the image collapse problems shown with aq. base development. The authors discuss the use of **carbon dioxide** to replace the most solvent intensive steps of the microlithog. process, spin coating, developing, and stripping. However, before **CO2** can replace conventional solvents, **photoresist** systems must be designed and synthesized to be compatible with **CO2**. These **photoresist** systems must be sol. in liq. **CO2** to insure that thin-uniform coatings can be produced by spin coating while maintaining characteristics of conventional resist systems such as low absorbance, high sensitivity, soly. contrast, good resoln., and etch resistance. Using the authors **CO2** compatible resist system, they demonstrate the ability of **CO2** to spin coat uniform thin-films which (after exposing and PEB) can be developed using **CO2** to produce lithog. features that may be stripped in **CO2**. Thus, revealing the enormous potential of **CO2** to provide the microlithog. industry an opportunity to escape its water and org. solvent dependence as it moves toward 157 nm lithog.
ST lithog **photoresist** system design microlithog **carbon dioxide**
IT **Photoresists**
(chem. amplified; deep-UV **photoresist** systems designed for microlithog. using **carbon dioxide** replacing org.- and aq. solvents in each step)
IT **124-38-9, Carbon dioxide,** properties
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PYP (Physical process); PROC (Process)
(deep-UV **photoresist** systems designed for microlithog. using **carbon dioxide** replacing org.- and aq. solvents in each step)
IT **246045-92-1,** 1,1-Dihydroperfluorooctyl methacrylate-tert-butyl methacrylate copolymer **256430-22-5,** 1,1-Dihydroperfluorooctyl methacrylate-tetrahydropyranyl methacrylate copolymer
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(deep-UV **photoresist** systems designed for microlithog. using **carbon dioxide** replacing org.- and aq. solvents in each step)
IT 168153-15-9 457632-31-4
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(photoacid generator; deep-UV **photoresist** systems designed for microlithog. using **carbon dioxide** replacing org.- and aq. solvents in each step)

RE.CNT 10 THERE ARE 10 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE
(1) Anon; US 5739223 1992 HCAPLUS
(2) Anon; SEMI E 10-96 Standard, Semiconductor Equipment and Materials International
(3) Desimone, J; Science 1992, V257, P945 HCAPLUS
(4) Goldfarb, D; J Vac Sci Technol B 2000, V18(6), P3313 HCAPLUS
(5) Kunz, R; J Vac Sci Technol B 1999, V17(6), P3267 HCAPLUS
(6) Mason, M; Sematech Next Generation Lithography Workshop 1998
(7) McAdams, C; Submitted to Proc SPIE Int Soc Opt Eng, Paper # 127 2001, P4345
(8) Moore, G; Proc SPIE Int Soc Opt Eng 1994, V2438, P2
(9) Okoroanyanwu, U; J Vac Sci Technol B 2000, V18(6), P3381 HCAPLUS
(10) Tanaka; J Appl Phys 1993, V32, P6059 HCAPLUS

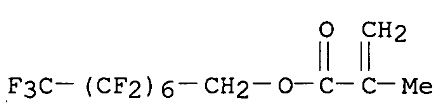
IT **124-38-9, Carbon dioxide,** properties
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PYP (Physical process); PROC (Process)
(deep-UV **photoresist** systems designed for microlithog. using **carbon dioxide** replacing org.- and aq. solvents in each step)
RN 124-38-9 HCAPLUS
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



IT **246045-92-1,** 1,1-Dihydroperfluorooctyl methacrylate-tert-butyl methacrylate copolymer **256430-22-5,** 1,1-Dihydroperfluorooctyl methacrylate-tetrahydropyranyl methacrylate copolymer
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(deep-UV **photoresist** systems designed for microlithog. using **carbon dioxide** replacing org.- and aq. solvents in each step)
RN 246045-92-1 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 1,1-dimethylethyl ester, polymer with 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

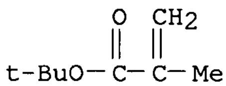
CM 1

CRN 3934-23-4
CMF C12 H7 F15 O2



CM 2

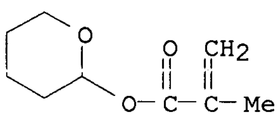
CRN 585-07-9
CMF C8 H14 O2



RN 256430-22-5 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

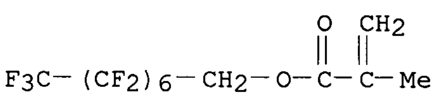
CM 1

CRN 52858-59-0
CMF C9 H14 O3



CM 2

CRN 3934-23-4
CMF C12 H7 F15 O2



L67 ANSWER 12 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 2002:501666 HCAPLUS
DN 137:239593
TI All **CO2**-processed fluoropolymer-containing **photoresist** systems
AU Flowers, Devin; Hoggan, Erik; DeSimone, Joseph M.; Carbonell, Ruben
CS Department of Chemistry, University of North Carolina at Chapel Hill, Chapel Hill, NC, 27599, USA
SO Materials Research Society Symposium Proceedings (2002), 705(Nanopatterning: From Ultralarge-Scale Integration to Biotechnology), 73-79
CODEN: MRSPDH; ISSN: 0272-9172
PB Materials Research Society
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
Section cross-reference(s): 76
AB Currently, the microlithog. industry creates large amts. of org. and aq. wastes in the prodn. of semiconductors. Using **carbon dioxide** can possibly eliminate the majority of these waste solvents as well as eliminate the image collapse problems shown with aq.

base development. The authors discuss the use of **carbon dioxide** to replace the most solvent intensive steps of the microlithog. process, spin coating, developing, and stripping. However, before **CO2** can replace conventional solvents, **photoresist** systems must be designed and synthesized to be compatible with **CO2**. These **photoresist** systems must be sol. in liq. **CO2** to insure that thin-uniform coatings can be produced by spin coating while maintaining characteristics of conventional resist systems such as low absorbance, high sensitivity, soly. contrast, good resoln., and etch resistance. Using **CO2** compatible resist system, the authors demonstrate the ability of **CO2** to spin coat uniform thin-films which (after exposing and PEB) can be developed using scCO2 to produce lithog. features that may be stripped in **CO2**. Thus, revealing the enormous potential of **CO2** to provide the microlithog. industry an opportunity to escape its water and org. solvent dependence as it moves toward 157 nm lithog.

ST **carbon dioxide** processed fluoropolymer **photoresist** lithog

IT **Photoresists**
(chem. amplified; fluoropolymer-contg. **photoresist** systems for use with **carbon dioxide** replacing all solvent intensive steps of microlithog. process)

IT Fluoropolymers, properties
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(fluoropolymer-contg. **photoresist** systems for use with **carbon dioxide** replacing all solvent intensive steps of microlithog. process)

IT Coating process
(spin; fluoropolymer-contg. **photoresist** systems for use with **carbon dioxide** replacing all solvent intensive steps of microlithog. process)

IT **124-38-9, Carbon dioxide**, processes
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process)
(fluoropolymer-contg. **photoresist** systems for use with **carbon dioxide** replacing all solvent intensive steps of microlithog. process)

IT **256430-22-5**, 1H,1H-Perfluorooctyl methacrylate-tetrahydropyranyl methacrylate copolymer
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(fluoropolymer-contg. **photoresist** systems for use with **carbon dioxide** replacing all solvent intensive steps of microlithog. process)

IT 168153-15-9 457632-31-4, 2-Perfluorohexyl-6-nitrobenzyl tosylate
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(photoacid generator; fluoropolymer-contg. **photoresist** systems for use with **carbon dioxide** replacing all solvent intensive steps of microlithog. process)

RE.CNT 9 THERE ARE 9 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE
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(2) Goldfarb, D; J Vac Sci Technol B 2000, V18(6), P3313 HCAPLUS
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(5) McAdams, C; Submitted to Proc SPIE Int Soc Opt Eng 2001, Paper # 127, P4345

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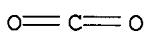
(7) Okoroanyanwu, U; J Vac Sci Technol B 2000, V18(6), P3381 HCAPLUS
(8) Semiconductor Equipment and Materials International; SEMI E10-96 Standard
(9) Tanaka, H; J Appl Phys 1993, V32, P6059

IT **124-38-9, Carbon dioxide,** processes
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process)
(fluoropolymer-contg. **photoresist** systems for use with **carbon dioxide** replacing all solvent intensive steps of microlithog. process)

RN 124-38-9 HCAPLUS

CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



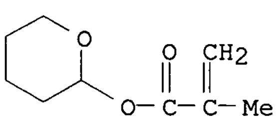
IT **256430-22-5,** 1H,1H-Perfluorooctyl methacrylate-tetrahydropyranyl methacrylate copolymer
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(fluoropolymer-contg. **photoresist** systems for use with **carbon dioxide** replacing all solvent intensive steps of microlithog. process)

RN 256430-22-5 HCAPLUS

CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

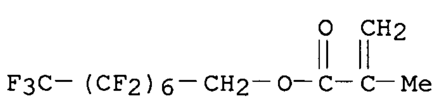
CM 1

CRN 52858-59-0
CMF C9 H14 O3



CM 2

CRN 3934-23-4
CMF C12 H7 F15 O2



L67 ANSWER 13 OF 21 HCAPLUS

AN 2002:293993 HCAPLUS

DN 136:316937

TI Polymers and **carbon dioxide** containing processes for

photoresists and microlithog.

IN Kendall, Jonathan; Desimone, Joseph M.; Carbonell, Ruben G.; McAdams, Christopher L.

PA University of North Carolina At Chapel Hill, USA; North Carolina State University

applicants

SO PCT Int. Appl., 49 pp.
CODEN: PIXXD2

DT Patent

LA English

IC ICM G03F007-004
ICS G03F007-26; G03F007-36

CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
Section cross-reference(s): 38

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2002031596	A1	20020418	WO 2001-US31504	20011010
	W: AU, BR, CA, CN, DE, ES, GB, JP, KR, MX, SG				
	RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR				
	AU 2001096737	A5	20020422	AU 2001-96737	20011010
	US 2002119398	A1	20020829	US 2001-975211	20011010
PRAI	US 2000-239749P	P	20001012		
	US 2001-267993P	P	20010209		
	WO 2001-US31504	W	20011010		

AB The present invention relates to processes to form microelectronic devices using **carbon dioxide**. A process of forming a resist image in a microelectronic substrate comprises the steps of contacting the substrate with a compn. first comprising **carbon dioxide** and a component selected from the group consisting of at least one polymeric precursor, at least one monomer, at least one polymeric material, and mixts. thereof to deposit the component on the substrate and form a coating thereon; then imagewise exposing the coating to radiation such that exposed and unexposed coating portions are formed; then subjecting the coating to a second compn. comprising **carbon dioxide** having such that either one of the exposed or the unexposed coating portions are removed from the substrate and the other coating portion is developed and remains on the coating to form an image thereon.

ST **photoresists** microelectronic device **carbon dioxide** photolithog

IT Photolithography
Photoresists
UV radiation
(polymers and **carbon dioxide** contg. processes for **photoresists** and microlithog.)

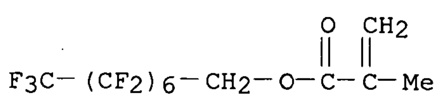
IT **27880-53-1**
RL: FMU (Formation, unclassified); TEM (Technical or engineered material use); FORM (Formation, nonpreparative); USES (Uses)
(polymers and **carbon dioxide** contg. processes for **photoresists** and microlithog.)

IT **246045-92-1**, tert-Butyl methacrylate-1,1'-dihydroperfluorooctyl methacrylate copolymer
RL: PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)
(polymers and **carbon dioxide** contg. processes for **photoresists** and microlithog.)

IT 124-38-9, Carbon dioxide, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(polymers and **carbon dioxide** contg. processes for **photoresists** and microlithog.)
IT 77-76-9 90201-17-5
RL: RCT (Reactant); RACT (Reactant or reagent)
(prepn. of polymers for **photoresists** and microlithog.)
IT **116-14-3DP**, Tetrafluoroethylene, polymer with norbornene derivs. and pinacol monomer 498-66-8DP, Norbornene, derivs., polymer with tetrafluoroethylene and pinacol monomer 411225-13-3DP, polymer with tetrafluoroethylene and norbornene derivs., hydrolyzed, pinacol rearranged
RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(prepn. of polymers for **photoresists** and microlithog.)
RE.CNT 4 THERE ARE 4 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE
(1) Allen; US 5665527 A 1997 HCAPLUS
(2) Desimone; US 6001418 A 1999
(3) Gleason; US 6045877 A 2000 HCAPLUS
(4) McClain; US 6165559 A 2000 HCAPLUS
IT **27880-53-1**
RL: FMU (Formation, unclassified); TEM (Technical or engineered material use); FORM (Formation, nonpreparative); USES (Uses)
(polymers and **carbon dioxide** contg. processes for **photoresists** and microlithog.)
RN 27880-53-1 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, polymer with 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

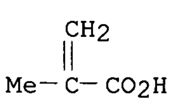
CM 1

CRN 3934-23-4
CMF C12 H7 F15 O2



CM 2

CRN 79-41-4
CMF C4 H6 O2

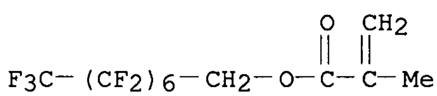


IT **246045-92-1**, tert-Butyl methacrylate-1,1'-dihydroperfluorooctyl methacrylate copolymer
RL: PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)
(polymers and **carbon dioxide** contg. processes for **photoresists** and microlithog.)

RN 246045-92-1 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 1,1-dimethylethyl ester, polymer with 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

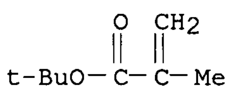
CM 1

CRN 3934-23-4
CMF C12 H7 F15 O2

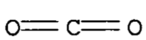


CM 2

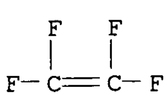
CRN 585-07-9
CMF C8 H14 O2



IT **124-38-9, Carbon dioxide,** uses
RL: TEM (Technical or engineered material use); USES (Uses)
(polymers and **carbon dioxide** contg. processes for **photoresists** and microlithog.)
RN 124-38-9 HCAPLUS
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



IT **116-14-3DP,** Tetrafluoroethylene, polymer with norbornene derivs. and pinacol monomer
RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(prepn. of polymers for **photoresists** and microlithog.)
RN 116-14-3 HCAPLUS
CN Ethene, tetrafluoro- (9CI) (CA INDEX NAME)



L67 ANSWER 14 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 2001:474233 HCAPLUS
DN 135:69596
TI Method for fabricating semiconductor device with a metal interconnection

contact hole in a peripheral circuit region
IN Kim, Jeong Ho; Kim, Yu Chang
PA S. Korea
SO U.S. Pat. Appl. Publ., 11 pp.
CODEN: USXXCO
DT Patent
LA English
IC ICM H01L021-302
NCL 438710000
CC 76-3 (Electric Phenomena)
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 2001005637	A1	20010628	US 2000-745429	20001226
	US 6258722	B1	20010710	US 1999-473471	19991228
PRAI	KR 1999-61852	A	19991224		

AB The present invention discloses a method for fabricating a semiconductor device. In a process for forming metal interconnection contact holes on both a gate electrode including an Si-rich SiON film as a mask insulating film in a peripheral circuit region and on a semiconductor substrate, the metal interconnection contact hole is formed according to a 3-step etching process using a **photoresist** film pattern exposing the intended locations of a metal interconnection contacts as an etching mask. Accordingly, contact properties are improved by preventing damage to the semiconductor substrate, thereby reducing leakage current and improving yield.
ST semiconductor device fabrication etching interconnection contact hole
IT Semiconductor devices
(electrodes; method for fabricating semiconductor device with a metal interconnection contact hole in a peripheral circuit region)
IT Perfluorocarbons
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(etchant; method for fabricating semiconductor device with a metal interconnection contact hole in a peripheral circuit region)
IT Contact holes
Dielectric films
Electric insulators
Etching
Etching masks
Interconnections (electric)
MOSFET (transistors)
Photomasks (lithographic masks)
Semiconductor device fabrication
(method for fabricating semiconductor device with a metal interconnection contact hole in a peripheral circuit region)
IT Electric contacts
(plugs; method for fabricating semiconductor device with a metal interconnection contact hole in a peripheral circuit region)
IT Electrodes
(semiconductive; method for fabricating semiconductor device with a metal interconnection contact hole in a peripheral circuit region)
IT 75-10-5, Difluoromethane 75-46-7, Trifluoromethane 75-73-0, Tetrafluoromethane 76-16-4, Hexafluoroethane 76-19-7, Octafluoropropane 115-25-3, Octafluorocyclobutane **116-14-3**, Tetrafluoroethene, processes 354-33-6, Pentafluoroethane 376-77-2, Decafluorocyclopentane 559-40-0, Octafluorocyclopentene 593-53-3, Fluoromethane 697-11-0, Hexafluorocyclobutene 931-91-9,

Hexafluorocyclopropane 7783-54-2, Nitrogen trifluoride
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(etchant; method for fabricating semiconductor device with a metal interconnection contact hole in a peripheral circuit region)

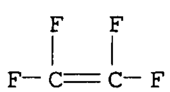
IT **124-38-9, Carbon dioxide,** processes
630-08-0, Carbon monoxide, processes 7440-01-9, Neon, processes 7440-37-1, Argon, processes 7440-59-7, Helium, processes 7440-63-3, Xenon, processes 7782-44-7, Oxygen, processes
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(etching mixt.; method for fabricating semiconductor device with a metal interconnection contact hole in a peripheral circuit region)

IT 7440-21-3, Silicon, uses 11105-01-4, Silicon nitride oxide 12033-89-5, Silicon nitride, uses
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(method for fabricating semiconductor device with a metal interconnection contact hole in a peripheral circuit region)

IT **116-14-3,** Tetrafluoroethene, processes
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(etchant; method for fabricating semiconductor device with a metal interconnection contact hole in a peripheral circuit region)

RN 116-14-3 HCAPLUS

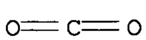
CN Ethene, tetrafluoro- (9CI) (CA INDEX NAME)



IT **124-38-9, Carbon dioxide,** processes
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(etching mixt.; method for fabricating semiconductor device with a metal interconnection contact hole in a peripheral circuit region)

RN 124-38-9 HCAPLUS

CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



L67 ANSWER 15 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN

AN 1999:800004 HCAPLUS

DN 132:144329

TI Supercritical **CO2** Processing for Submicron Imaging of Fluoropolymers

AU Sundararajan, Narayan; Yang, Shu; Ogino, Kenji; Valiyaveettil, Suresh; Wang, Jianguo; Zhou, Xinyi; Ober, Christopher K.; Obendorf, Sharon K.; Allen, Robert D.

CS Department of Materials Science and Engineering, Cornell University, Ithaca, NY, 14853, USA

SO Chemistry of Materials (2000), 12(1), 41-48
CODEN: CMATEX; ISSN: 0897-4756

PB American Chemical Society
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
Section cross-reference(s): 35, 36
AB To keep pace with the ever-shrinking feature sizes required in the microelectronics industry, suitable developers with high diffusivities, selectivity, and adjustable solvating power are required. Supercrit. fluid (SCF) **CO2** possesses many of the above unique properties and could serve as an environmentally responsible alternative developer to aq. base. The high soly. of fluorinated block copolymers in supercrit. **CO2** and the selectivity of supercrit. **CO2** to both polarity changes and the mol. structure of the polymer were used to develop an environmentally friendly lithog. process. Polymers with acid-cleaving tetrahydropyranyl groups and supercrit. **CO2** sol., fluoro-side-chain-contg. methacrylate groups were synthesized with varying vol. fractions of the components, and their solubilities in supercrit. **CO2** were characterized. Chem. amplification was used to effect the polarity change leading to the soly. difference in supercrit. **CO2**, and the lithog. performance was evaluated. Important parameters such as sensitivity, contrast, and resoln. were studied, and 0.2 .mu.m features using supercrit. **CO2** development were demonstrated.
ST supercrit **carbon dioxide** submicron imaging fluoropolymer; tetrahydropyranyl perfluorobutyl perfluorooctyl methacrylate block polymer lithog
IT Dissolution
Imaging
Lithography
Molecular structure
Photoresists
Supercritical fluids
(supercrit. **CO2** processing for submicron imaging of fluoropolymers)
IT Fluoropolymers, reactions
Polymers, reactions
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); RCT (Reactant); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); RACT (Reactant or reagent); USES (Uses)
(supercrit. **CO2** processing for submicron imaging of fluoropolymers)
IT 52858-60-3P, Tetrahydropyranyl methacrylate homopolymer
204643-92-5P 256430-22-5P, Tetrahydropyranyl methacrylate-1H,1H-perfluorooctyl methacrylate copolymer
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); RCT (Reactant); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); RACT (Reactant or reagent); USES (Uses)
(supercrit. **CO2** processing for submicron imaging of fluoropolymers)
IT **124-38-9, Carbon dioxide,** reactions
RL: NUU (Other use, unclassified); RCT (Reactant); RACT (Reactant or reagent); USES (Uses)
(supercrit. **CO2** processing for submicron imaging of fluoropolymers)
IT **212389-71-4P**

RL: PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); RCT (Reactant); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); RACT (Reactant or reagent); USES (Uses)
(supercrit. **CO2** processing for submicron imaging of fluoropolymers)

RE.CNT 36 THERE ARE 36 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

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(2) Allen, R; Proc SPIE 1995, V2438, P250 HCAPLUS
(3) DeSimone, J; Macromolecules 1994, V27, P5527
(4) DeSimone, J; Polym Mater Sci Eng 1998, V79, P290
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(30) Sundararajan, N; Proc 11th Int SPE Conf Photopolym 1997, P59
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(34) Wang, J; Macromolecules 1997, V30, P1906 HCAPLUS
(35) Yang, S; Chem Mater submitted
(36) Ziger, D; AIChE J 1987, V22, P1585

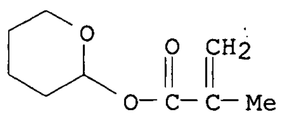
IT **204643-92-5P 256430-22-5P**, Tetrahydropyranyl methacrylate-1H,1H-perfluorooctyl methacrylate copolymer
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); RCT (Reactant); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); RACT (Reactant or reagent); USES (Uses)
(supercrit. **CO2** processing for submicron imaging of fluoropolymers)

RN 204643-92-5 HCAPLUS

CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,4-heptafluorobutyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate, block (9CI) (CA INDEX NAME)

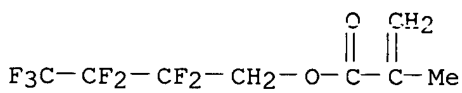
CM 1

CRN 52858-59-0
CMF C9 H14 O3



CM 2

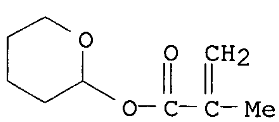
CRN 13695-31-3
CMF C8 H7 F7 O2



RN 256430-22-5 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

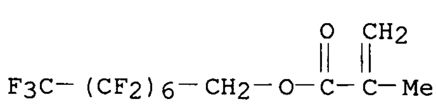
CM 1

CRN 52858-59-0
CMF C9 H14 O3



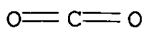
CM 2

CRN 3934-23-4
CMF C12 H7 F15 O2



IT **124-38-9, Carbon dioxide,** reactions
RL: NUU (Other use, unclassified); RCT (Reactant); RACT (Reactant or reagent); USES (Uses)
(supercrit. **CO2** processing for submicron imaging of fluoropolymers)
RN 124-38-9 HCAPLUS

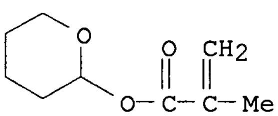
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



IT **212389-71-4P**
RL: PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); RCT (Reactant); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); RACT (Reactant or reagent); USES (Uses)
(supercrit. **CO2** processing for submicron imaging of fluoropolymers)
RN 212389-71-4 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate, block (9CI) (CA INDEX NAME)

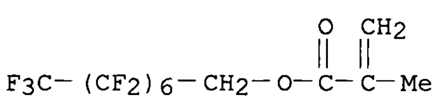
CM 1

CRN 52858-59-0
CMF C9 H14 O3



CM 2

CRN 3934-23-4
CMF C12 H7 F15 O2



L67 ANSWER 16 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 1999:513129 HCAPLUS
DN 131:293194
TI Spin coating and photolithography using liquid and supercritical **carbon dioxide**
AU Hoggan, Erik N.; Kendall, Jonathan L.; Flowers, Devin; Carbonell, Ruben G.; DeSimone, Joseph M.
CS Department of Chemical Engineering, North Carolina State University, Raleigh, NC, 27606, USA
SO Polymeric Materials Science and Engineering (1999), 81, 47-48
CODEN: PMSEDG; ISSN: 0743-0515
PB American Chemical Society
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other

Reprographic Processes)
Section cross-reference(s): 76

AB The conventional manufg. of integrated circuits utilizes two solvent intensive steps, spin coating of a **photoresist** layer and the development of the image after exposure. This creates vast amts. of solvent waste. For example, a typical semiconductor processing line which produces 5,000 wafers per day will generate 2,000 gal of waste developing soln. and an equiv. amt. of contaminated rinse water. **Carbon dioxide** is a promising alternative, it is non-toxic, non-flammable, inexpensive and recyclable. The synthesis of suitable **CO2** sol. resists, and construction of a suitable high pressure app. coating is described. A series of random copolymers of perfluorooctyl methacrylate (FOMA) and tert-Bu methacrylate (TBM) were synthesized as neg. resists for deep-UV lithog. Poly(FOMA-r-TBM) in combination with a photoacid generator (PAG) may be employed as a **photoresist**. Upon irradn., the PAG produces an acid which catalyzes the release of isobutylene from TBM, leaving an insol. methacrylic acid (MAA). The polymers were synthesized homogeneously in supercrit. **CO2**, at 345 bar using azobisisobutronitrile (AIBN) as an initiator. Copolymers contg. 0, 12, 20, and 33 mol% TBM were synthesized. Although all of the polymers synthesized were sol. in **CO2** at moderate pressures (<100 bar), none were sol. at vapor pressure at room temp. However, because the d. of liq. **CO2** at vapor pressure increases greatly with lowering temp., the polymers were sol. at sub-ambient temps. The solubilities of the polymers were detd. by isothermally lowering the pressure of a **CO2**-polymer mixt. until the cloud point was obsd. All of the polymers were sol. in **CO2** at vapor pressure between 15 and 18 .degree.C, even up to 20 wt. percent solids.

ST spin coating photolithog resist liq supercrit **carbon dioxide**; perfluorooctyl butyl methacrylate polymer resist **carbon dioxide** solvent lithog

IT Coating apparatus
Integrated circuits
Photoresists
(spin coating of photolithog. resists using liq. and supercrit. **carbon dioxide**)

IT Coating process
(spin; spin coating of photolithog. resists using liq. and supercrit. **carbon dioxide**)

IT 246045-94-3P
RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(photoacid generator; spin coating of photolithog. resists using liq. and supercrit. **carbon dioxide**)

IT 355-43-1, Perfluorohexyl iodide
RL: RCT (Reactant); RACT (Reactant or reagent)
(reaction with 4-bromo-2-nitrotoluene)

IT 60956-26-5, 4-Bromo-2-nitrotoluene
RL: RCT (Reactant); RACT (Reactant or reagent)
(reaction with perfluorohexyl iodide)

IT **124-38-9P, Carbon dioxide,** preparation
RL: IMF (Industrial manufacture); PREP (Preparation)
(spin coating of photolithog. resists using liq. and supercrit. **carbon dioxide**)

IT **246045-92-1P,** tert-Butyl methacrylate-1H,1H-perfluorooctyl methacrylate copolymer
RL: SPN (Synthetic preparation); TEM (Technical or engineered material

use); PREP (Preparation); USES (Uses)
(spin coating of photolithog. resists using liq. and supercrit. **carbon dioxide**)

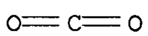
RE.CNT 8 THERE ARE 8 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE
(1) Allen, R; US 5665527 1997 HCAPLUS
(2) DeSimone, J; Science 1992, V257, P945 HCAPLUS
(3) Emslie, A; J Appl Phys 1957, V29
(4) McHugh, M; Supercritical Fluid Extraction: Principles and Practice 2nd ed 1993
(5) Nakamura, J; Jpn J Appl Phys Part 1 1992, V31, P4294 HCAPLUS
(6) Ober, C; Adv Mater 1997, V9, P1039 HCAPLUS
(7) Reichmanis, E; Polymeric Materials Encyclopedia 1996, V2, P1170
(8) Wetmore, P; Supercritical Fluid Technology for Photoresist Developing 1997

IT **124-38-9P, Carbon dioxide,** preparation
RL: IMF (Industrial manufacture); PREP (Preparation)
(spin coating of photolithog. resists using liq. and supercrit. **carbon dioxide**)

RN 124-38-9 HCAPLUS

CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



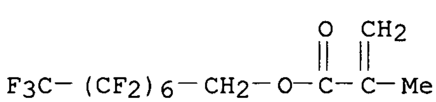
IT **246045-92-1P,** tert-Butyl methacrylate-1H,1H-perfluorooctyl methacrylate copolymer
RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(spin coating of photolithog. resists using liq. and supercrit. **carbon dioxide**)

RN 246045-92-1 HCAPLUS

CN 2-Propenoic acid, 2-methyl-, 1,1-dimethylethyl ester, polymer with 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

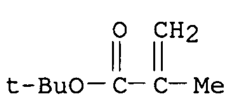
CM 1

CRN 3934-23-4
CMF C12 H7 F15 O2



CM 2

CRN 585-07-9
CMF C8 H14 O2



L67 ANSWER 17 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 1998:546254 HCAPLUS
DN 129:223147
TI Block copolymers as supercritical **CO2** developable **photoresists**
AU Sundararajan, Narayan; Valiyaveettil, Suresh; Ogino, Kenji; Zhou, Xinyi; Wang, Jianguo; Yang, Shu; Ober, Christopher K.
CS Dep. Mater. Sci. Eng., Cornell Univ., Ithaca, NY, 14853, USA
SO Polymeric Materials Science and Engineering (1998), 79, 130-131
CODEN: PMSEDG; ISSN: 0743-0515
PB American Chemical Society
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
AB The objective of this study was to utilize the concept of block copolymers and their unique properties to provide an environmentally friendly process for the fabrication of sub-0.3 .mu.m features using supercrit. **carbon dioxide** development. Block copolymers such as tetrahydropyranyl methacrylate-heptafluoropropylmethyl methacrylate (THPMA-F3MA) and tetrahydropyranyl methacrylate-pentadecafluoroheptylmethyl methacrylate (THPMA-F7MA) with different vol. and molar ratio were synthesized by group transfer polymn. THPMA was introduced first, initiated by 1-methoxyl-trimethylsiloxy-2-methyl-1-propene (MTMS) with tetrabutylammonium biacetate (TBAB) as a catalyst in THF. F3MA or F7MA was then added as second block and then, polymd. The optimum conditions for dissoln. of the virgin polymer before exposure were detd. by evaluating the dissoln. characteristics of the polymer at different pressure, temp., flow rate of **CO2** and time of development. After exposure, the proton generated from the photoacid generator cleaves the acid-labile group in the THPMA component block copolymer and converts it into methacrylic acid. This gives rise to a polarity change which then makes the polymer insol. in supercrit. **CO2** after exposure. A plot of film thickness after development vs. exposure dose gives an understanding of the sensitivity of the **photoresist**.
ST tetrahydropyranyl methacrylate fluoromethacrylate block copolymer resist; copolymer supercrit **carbon dioxide** developable **photoresist**
IT Dissolution
Imaging
Lithography
Photoresists
Polarity
Thickness
(block copolymers as supercrit. **CO2** developable **photoresists**)
IT Fluoropolymers, uses
Polymers, uses
RL: NUU (Other use, unclassified); TEM (Technical or engineered material use); USES (Uses)
(block copolymers as supercrit. **CO2** developable **photoresists**)
IT **204643-92-5 212389-71-4**
RL: NUU (Other use, unclassified); TEM (Technical or engineered material use); USES (Uses)

(block copolymers as supercrit. **CO2** developable **photoresists**)

IT **124-38-9, Carbon dioxide,** reactions
212389-73-6
RL: RCT (Reactant); RACT (Reactant or reagent)
(block copolymers as supercrit. **CO2** developable **photoresists**)

RE.CNT 6 THERE ARE 6 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE
(1) Bates, F; Annu Rev Phys Chem 1990, V41, P525 HCAPLUS
(2) Dixon, D; Supercritical fluids, Kirk-Othmer Encycopaedia of Chemical Technology, 4th ed 1992, V23, P452
(3) McHugh, M; Supercritical Fluid Extraction:Principles and Practice, 2nd ed 1994
(4) Ogawa, T; J Photopolym Sci Technol 1996, V9, P379 HCAPLUS
(5) Reichmanis, E; ACS Symp Ser 1989, V412, P1 HCAPLUS
(6) Sogah, D; Macromolecules 1987, V20, P1473 HCAPLUS

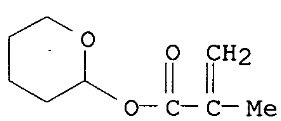
IT **204643-92-5 212389-71-4**
RL: NUU (Other use, unclassified); TEM (Technical or engineered material use); USES (Uses)
(block copolymers as supercrit. **CO2** developable **photoresists**)

RN 204643-92-5 HCAPLUS

CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,4-heptafluorobutyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate, block (9CI) (CA INDEX NAME)

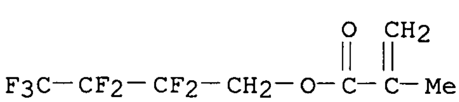
CM 1

CRN 52858-59-0
CMF C9 H14 O3



CM 2

CRN 13695-31-3
CMF C8 H7 F7 O2

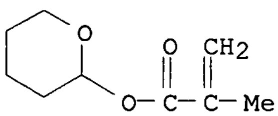


RN 212389-71-4 HCAPLUS

CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluorooctyl ester, polymer with tetrahydro-2H-pyran-2-yl 2-methyl-2-propenoate, block (9CI) (CA INDEX NAME)

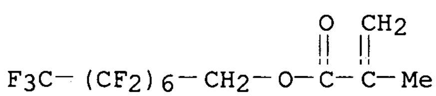
CM 1

CRN 52858-59-0
CMF C9 H14 O3

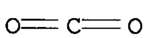


CM 2

CRN 3934-23-4
CMF C12 H7 F15 O2



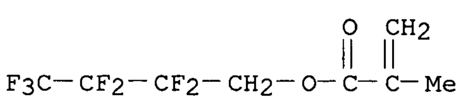
IT **124-38-9, Carbon dioxide,** reactions
212389-73-6
RL: RCT (Reactant); RACT (Reactant or reagent)
(block copolymers as supercrit. **CO2** developable **photoresists**)
RN 124-38-9 HCAPLUS
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)



RN 212389-73-6 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, polymer with 2,2,3,3,4,4,4-heptafluorobutyl 2-methyl-2-propenoate, block (9CI) (CA INDEX NAME)

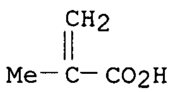
CM 1

CRN 13695-31-3
CMF C8 H7 F7 O2



CM 2

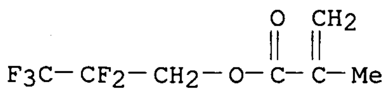
CRN 79-41-4
CMF C4 H6 O2



L67 ANSWER 18 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 1997:727112 HCAPLUS
DN 128:13694
TI Imaging polymers with supercritical **carbon dioxide**
AU Ober, Christopher K.; Gabor, Allen H.; Gallagher-Wetmore, Paula; Allen, Robert D.
CS Materials Science Engineering, Cornell Univ., Ithaca, NY, 14853, USA
SO Advanced Materials (Weinheim, Germany) (1997), 9(13), 1039-1043
CODEN: ADVMEW; ISSN: 0935-9648
PB Wiley-VCH Verlag GmbH
DT Journal
LA English
CC 37-5 (Plastics Manufacture and Processing)
Section cross-reference(s): 74
AB Several imageable copolymers for neg.-tone supercrit. fluid **CO2** -developable resists produced from combinations of t-Bu methacrylate with either 3-methacryloxypropyl methacrylate or pentafluoropropyl methacrylate are described. The dependence of soly. on compn. of the copolymer and on pressure and temp. of the solvent is presented, as is the effect of exposure dosage (at 248.4 nm) on the thickness of remaining polymer film following development with supercrit. **CO2**.
ST **carbon dioxide** supercrit imaging polymer lithog; nanostructure polymethacrylate **photoresist** supercrit **carbon dioxide**
IT Lithography
Photoresists
(imaging polymers with supercrit. **carbon dioxide**)
IT Fluoropolymers, properties
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process)
(imaging polymers with supercrit. **carbon dioxide**)
IT 92459-75-1 **95243-53-1** 156291-95-1 168476-75-3 **199007-59-5**
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process)
(imaging polymers with supercrit. **carbon dioxide**)
IT **95243-53-1 199007-59-5**
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process)
(imaging polymers with supercrit. **carbon dioxide**)
RN 95243-53-1 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,3-pentafluoropropyl ester, homopolymer (9CI) (CA INDEX NAME)

CM 1

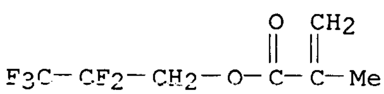
CRN 45115-53-5
CMF C7 H7 F5 O2



RN 199007-59-5 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 1,1-dimethylethyl ester, polymer with 2,2,3,3,3-pentafluoropropyl 2-methyl-2-propenoate (9CI) (CA INDEX NAME)

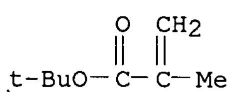
CM 1

CRN 45115-53-5
CMF C7 H7 F5 O2



CM 2

CRN 585-07-9
CMF C8 H14 O2



L67 ANSWER 19 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 1997:383567 HCAPLUS
DN 127:26082
TI Antireflective coating materials containing fluoropolymers and pattern formation
IN Tsuchiya, Junji; Watanabe, Satoshi; Takemura, Katsuya; Nagura, Shigehiro; Ishihara, Toshinobu
PA Shin-Etsu Chemical Industry Co., Ltd., Japan
SO Jpn. Kokai Tokkyo Koho, 10 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
IC ICM G03F007-004
ICS G03F007-11; H01L021-027
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
Section cross-reference(s): 37
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 09090615	A2	19970404	JP 1995-284281	19950927
PRAI	JP 1995-284281		19950927		

AB Claimed coating materials contain water-sol. fluoropolymers (CR1R2CR3R4)m(CHR5CR6R7)n, [CH2CR8(OR4)]m(CHR5CR6R7)n, and/or {CH2CR8[

CO2(CH2)cNR9O2SR4]}m(CHR5CR6R7)n (R1, R2 = H or F; R3 = H, F, Me, CF3; R4 = (CH2)a(CF2)bX or CR10R11R12; R5 = H, Me, CO2H; R6 = H, Me, CO2H, CH2CO2H; R7 = CO2H; sulfo, C(:O)YR13CO2H, C(:O)YR13SO3H; R8 = H, Me; R9 = H, C1-6 alkyl; R10-12 = H, F, CF3; R13 = C1-6 alkylene; X = H, F; Y = O, NH; a = 0-2; b = 1-8; c = 2-5; m:n = 1:9-9:1). Claimed process comprises coating the materials on **photoresist** films, imagewise exposure, and simultaneous removal of the coatings and development by alkali solns. Also claimed process comprises removal of coatings by water followed by removal of resist films by alkali aq. solns. Resulting products have good dimensional accuracy.

ST **photoresist** antireflective coating fluoropolymer

IT Antireflective films
Coating materials
Photoresists
(antireflective coating materials contg. fluoropolymers and pattern formation for dimensional accuracy)

IT Fluoropolymers, processes
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(antireflective coating materials contg. fluoropolymers and pattern formation for dimensional accuracy)

IT 61778-05-0P, Acrylic acid-vinylidene fluoride copolymer 190073-08-6P, 2-Acrylamido-2-methyl-1-propanesulfonic acid-vinylidene fluoride copolymer 190073-10-0P, 2-Acrylamido-2-methyl-1-propanesulfonic acid; 1H,1H-heptafluorobutylvinyl ether copolymer **190073-12-2P**, 2-Acrylamido-2-methyl-1-propanesulfonic acid; N-(.beta.-acryloyloxyethyl)perfluorooctane sulfonamide copolymer 190073-14-4P, 2-Acrylamido-2-methyl-1-propanesulfonic acid-tetrafluoroethylene copolymer
RL: PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses)
(antireflective coating materials contg. fluoropolymers and pattern formation for dimensional accuracy)

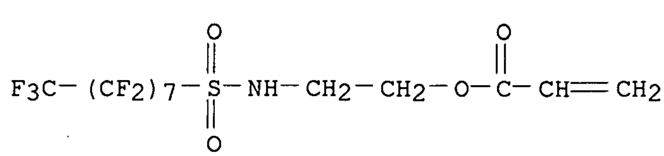
IT **190073-12-2P**, 2-Acrylamido-2-methyl-1-propanesulfonic acid; N-(.beta.-acryloyloxyethyl)perfluorooctane sulfonamide copolymer
RL: PEP (Physical, engineering or chemical process); PNU (Preparation, unclassified); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses)
(antireflective coating materials contg. fluoropolymers and pattern formation for dimensional accuracy)

RN 190073-12-2 HCAPLUS

CN 2-Propenoic acid, 2-[[(heptadecafluorooctyl)sulfonyl]amino]ethyl ester, polymer with 2-methyl-2-[(1-oxo-2-propenyl)amino]-1-propanesulfonic acid (9CI) (CA INDEX NAME)

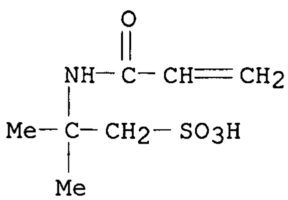
CM 1

CRN 60194-47-0
CMF C13 H8 F17 N O4 S



CM 2

CRN 15214-89-8
CMF C7 H13 N O4 S



L67 ANSWER 20 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 1995:829567 HCAPLUS
DN 124:18227
TI Supercritical fluid processing: A new dry technique for **photoresist** developing
AU Gallagher-Wetmore, Paula; Wallraff, Gregory M.; Allen, Robert D.
CS Phasex Corporation, Lawrence, MA, 01843, USA
SO Proceedings of SPIE-The International Society for Optical Engineering (1995), 2438(Advances in Resist Technology and Processing XII), 694-708
CODEN: PSISDG; ISSN: 0277-786X
PB SPIE-The International Society for Optical Engineering
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
AB Supercrit. fluid (SCF) technol. is investigated as a dry technique for **photoresist** developing. Because of their unique combination of gaseous and liq.-like properties, these fluids offer comparative or improved efficiencies over liq. developers and, particularly **carbon dioxide**, would have tremendous beneficial impact on the environment and on worker safety. Addnl., SCF technol. offers the potential for processing advanced resist systems which are currently under investigation as well as those that may have been abandoned due to problems assocd. with conventional developers. An investigation of various neg. and pos. **photoresist** systems is ongoing. Initially, supercrit. **carbon dioxide** (SC **CO2**) as a developer for polysilane resists was explored because the exposure products, polysiloxanes, are generally sol. in this fluid. These initial studies demonstrated the viability of the SCF technique with both single layer and bilayer systems. Subsequently, the investigation focused on using SC **CO2** to produce neg. images with polymers that would typically be considered pos. resists. Polymers such as styrenes and methacrylates were chem. modified by fluorination and/or copolymn. to render them sol. in SC **CO2**. Siloxane copolymers and siloxane-modified methacrylates were examd. as well. The preliminary findings reported here indicate the feasibility of using SC **CO2** for **photoresist** developing.
ST lithog **photoresist** development supercrit fluid processing; **carbon dioxide** supercrit fluid **photoresist** development
IT Fluoropolymers

Polysilanes
Siloxanes and Silicones, processes
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(**photoresist** development with **carbon dioxide** supercrit. fluid)

IT Phenolic resins, processes
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(novolak, **photoresist** development with **carbon dioxide** supercrit. fluid)

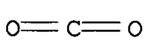
IT Resists
(photo-, **photoresist** development with **carbon dioxide** supercrit. fluid)

IT **124-38-9, Carbon dioxide,** processes
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(dry technique for **photoresist** development with **carbon dioxide** supercrit. fluid)

IT 25189-00-8, tert-Butyl methacrylate homopolymer 26838-55-1, 2,3,4,5,6-Pentafluorostyrene homopolymer **29036-65-5,** 2,2,3,3,3-Pentafluoropropyl acrylate homopolymer 31287-32-8, 3-Fluorostyrene homopolymer 76188-55-1, Poly(methylphenylsilane) 77884-24-3, 4-Trifluoromethylstyrene homopolymer 88002-85-1, Dichlorocyclohexylmethylsilane homopolymer 88003-16-1, Poly(cyclohexylmethylsilane) **95243-53-1,** 2,2,3,3,3-Pentafluoropropyl methacrylate homopolymer 146088-00-8, Poly(methylphenylsilane) 156048-34-9, Dimethylsilanediol-diphenylsilanediol copolymer 156291-95-1 168476-75-3
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(**photoresist** development with **carbon dioxide** supercrit. fluid)

IT **124-38-9, Carbon dioxide,** processes
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(dry technique for **photoresist** development with **carbon dioxide** supercrit. fluid)

RN 124-38-9 HCAPLUS
CN Carbon dioxide (8CI, 9CI) (CA INDEX NAME)

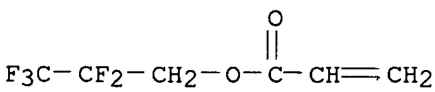


IT **29036-65-5,** 2,2,3,3,3-Pentafluoropropyl acrylate homopolymer
95243-53-1, 2,2,3,3,3-Pentafluoropropyl methacrylate homopolymer
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(**photoresist** development with **carbon dioxide** supercrit. fluid)

RN 29036-65-5 HCAPLUS
CN 2-Propenoic acid, 2,2,3,3,3-pentafluoropropyl ester, homopolymer (9CI) (CA INDEX NAME)

CM 1

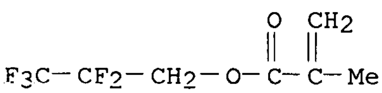
CRN 356-86-5
CMF C6 H5 F5 O2



RN 95243-53-1 HCAPLUS
CN 2-Propenoic acid, 2-methyl-, 2,2,3,3,3-pentafluoropropyl ester, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 45115-53-5
CMF C7 H7 F5 O2



L67 ANSWER 21 OF 21 HCAPLUS COPYRIGHT 2003 ACS on STN
AN 1981:75605 HCAPLUS
DN 94:75605
TI Device and methods for chemical treatment of articles
IN Denison, Dean R.; Hartsough, Larry D.
PA Perkin-Elmer Corp., USA
SO Ger. Offen., 16 pp.
CODEN: GWXXBX
DT Patent
LA German
IC B23K026-14; H01L021-306; B44C001-22; C23F001-00
CC 76-13 (Electric Phenomena)
Section cross-reference(s): 73
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	DE 3013679	A1	19801113	DE 1980-3013679	19800409
	US 4260649	A	19810407	US 1979-36828	19790507
	CH 644898	A	19840831	CH 1980-2879	19800415
	NL 8002566	A	19801111	NL 1980-2566	19800502
	FR 2456145	A1	19801205	FR 1980-9966	19800505
	FR 2456145	B1	19850322		
	GB 2048786	A	19801217	GB 1980-15008	19800506
	GB 2048786	B2	19830106		
	JP 55149643	A2	19801121	JP 1980-59544	19800507
	JP 63001097	B4	19880111		
PRAI	US 1979-36828		19790507		

AB Articles, esp. semiconductor wafers, are selectively chem. treated by means of laser-induced dissocn. of gases to form the desired reactive species. The laser wavelength is chosen so that only the desired reaction product is obtained. Thus, for selective etching of a SiO2 layer on a Si wafer, CF3I is passed into a chamber contg. the wafer and irradiated with a 10-ns to 1-.mu.s pulse from a **CO2** laser at 9.6 .mu.m and 1.2 J/cm2. The CF3I dissocd. into I and CF3, and the CF3 reacted with the SiO2 to form SiF4 and O2, which were pumped out of the system.
ST chem treatment semiconductor wafer; silica etching laser induced dissocn;

chlorofluoromethane laser induced dissocn; fluorotrichloromethane laser induced dissocn; methane trichlorofluoro laser induced dissocn; fluoromethyl radical etching silica

IT Semiconductor devices
(chem. treatment of wafers for, laser-induced photolysis in)

IT Oxidation
(of **photoresist** on semiconductor wafers, by laser-produced radicals)

IT Etching
(of semiconductor wafers, by laser-induced radicals)

IT Radicals, reactions
RL: USES (Uses)
(reactions of laser-produced, with semiconductor wafers)

IT Photolysis
(laser-induced, in chem treatment of semiconductor wafers)

IT Resists
(photo-, oxidn. of, by laser-produced radicals)

IT 7631-86-9, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(etching of, on silicon wafers, by laser-produced radicals)

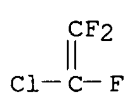
IT 56-23-5, properties 75-45-6 75-46-7 75-61-6 75-63-8 75-69-4 75-71-8 75-73-0 **79-38-9** 334-99-6 353-50-4 359-11-5 359-40-0 558-22-5 684-16-2 1511-62-2 2314-97-8 7664-41-7, reactions 7782-44-7, reactions 7803-62-5, reactions 10036-47-2 10294-34-5 13693-10-2
RL: RCT (Reactant); RACT (Reactant or reagent)
(photolysis of, laser-induced, in chem. treatment of semiconductor wafers)

IT 1871-24-5 2154-59-8 2264-21-3 3889-75-6 13842-52-9 14762-94-8, reactions 17778-80-2, reactions 20583-55-5 22537-15-1, reactions 31685-31-1 33146-36-0
RL: USES (Uses)
(reactions of laser-produced, with semiconductor wafers)

IT **79-38-9**
RL: RCT (Reactant); RACT (Reactant or reagent)
(photolysis of, laser-induced, in chem. treatment of semiconductor wafers)

RN 79-38-9 HCAPLUS

CN Ethene, chlorotrifluoro- (9CI) (CA INDEX NAME)



=> D QUE

L36	1 SEA FILE=REGISTRY ABB=ON	"1,1-DIHYDROPERFLUOROOCTYL ACRYLATE"/CN
L37	1 SEA FILE=REGISTRY ABB=ON	.ALPHA.-FLUOROSTYRENE/CN
L38	1 SEA FILE=REGISTRY ABB=ON	"HEXAFLUOROPROPYLENE OXIDE"/CN
L41	1 SEA FILE=REGISTRY ABB=ON	TETRAFLUOROETHYLENE/CN
L42	1 SEA FILE=REGISTRY ABB=ON	"VINYLIDENE FLUORIDE"/CN
L43	1 SEA FILE=REGISTRY ABB=ON	CHLOROTRIFLUOROETHYLENE/CN
L44	1 SEA FILE=REGISTRY ABB=ON	"PERFLUORO(PROPYL VINYL ETHER)"/CN
L45	1 SEA FILE=REGISTRY ABB=ON	"PERFLUORO(METHYL VINYL ETHER)"/CN

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L46           79 SEA FILE=REGISTRY ABB=ON  BIS AND TRIFLUOROMETHYL AND 4(W)5(W)D
                 IFLUORO AND DIOXOLE
L47           23 SEA FILE=REGISTRY ABB=ON  C5F8O2/MF
L48            1 SEA FILE=REGISTRY ABB=ON  L46 AND L47
L49           11 SEA FILE=REGISTRY ABB=ON  C11H5F9/MF
L50           10 SEA FILE=REGISTRY ABB=ON  L49 AND 1/NR
L51            1 SEA FILE=REGISTRY ABB=ON  L50 AND BENZENE AND 2(W)ETHENYL
L52           10 SEA FILE=REGISTRY ABB=ON  L36 OR L37 OR L51 OR L38 OR L41 OR
                 L42 OR L43 OR L44 OR L45 OR L48
L53              STR
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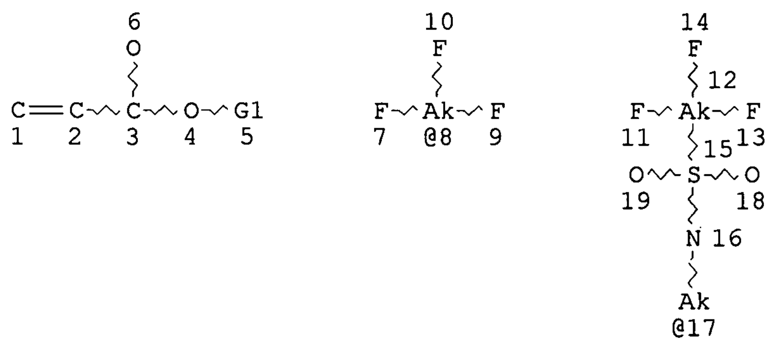

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VAR G1=8/17
NODE ATTRIBUTES:
DEFAULT MLEVEL IS ATOM
DEFAULT ECLEVEL IS LIMITED

GRAPH ATTRIBUTES:
RING(S) ARE ISOLATED OR EMBEDDED
NUMBER OF NODES IS  19

STEREO ATTRIBUTES: NONE
L55        14225 SEA FILE=REGISTRY SSS FUL L53
L56            1 SEA FILE=REGISTRY ABB=ON  CARBON DIOXIDE/CN
L57         8065 SEA FILE=HCAPLUS ABB=ON  L52
L58         6374 SEA FILE=HCAPLUS ABB=ON  L55
L59       169846 SEA FILE=HCAPLUS ABB=ON  L56
L60          395 SEA FILE=HCAPLUS ABB=ON  (L57 OR L58) AND L59
L61           92 SEA FILE=HCAPLUS ABB=ON  (L57 OR L58)(L)PHOTORESIST?
L62            9 SEA FILE=HCAPLUS ABB=ON  L60 AND L61
L63            9 SEA FILE=HCAPLUS ABB=ON  L61 AND (CO2 OR CARBON DIOXIDE)
L64            9 SEA FILE=HCAPLUS ABB=ON  L62 OR L63
L65           16 SEA FILE=HCAPLUS ABB=ON  L60 AND PHOTORESIST?
L66           21 SEA FILE=HCAPLUS ABB=ON  (L57 OR L58) AND PHOTORESIST? AND
                 (CO2 OR CARBON DIOXIDE)
L67           21 SEA FILE=HCAPLUS ABB=ON  (L62 OR L63 OR L64 OR L65 OR L66)
L69            6 SEA FILE=HCAPLUS ABB=ON  (L57 OR L58) AND MICROLITHOG? AND
                 (CO2 OR CARBON DIOXIDE)
L70            5 SEA FILE=HCAPLUS ABB=ON  (L57 OR L58) AND MICROLITHOG? AND L59

L71            6 SEA FILE=HCAPLUS ABB=ON  L69 OR L70
L72            0 SEA FILE=HCAPLUS ABB=ON  (L67 OR L71) NOT L67
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no additional answers with microlithog?